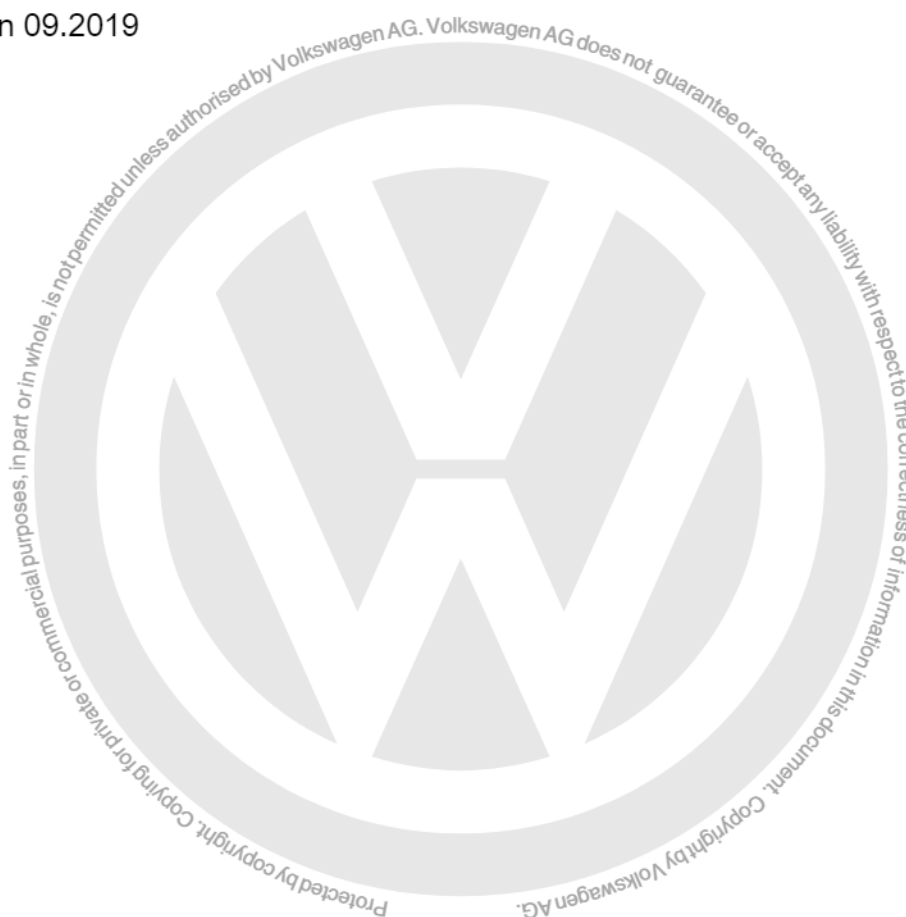




Workshop Manual Fox 2004 ➤

3 - Cyl. diesel engine (1.4 l)								
Engine ID	BNM							

Edition 09.2019

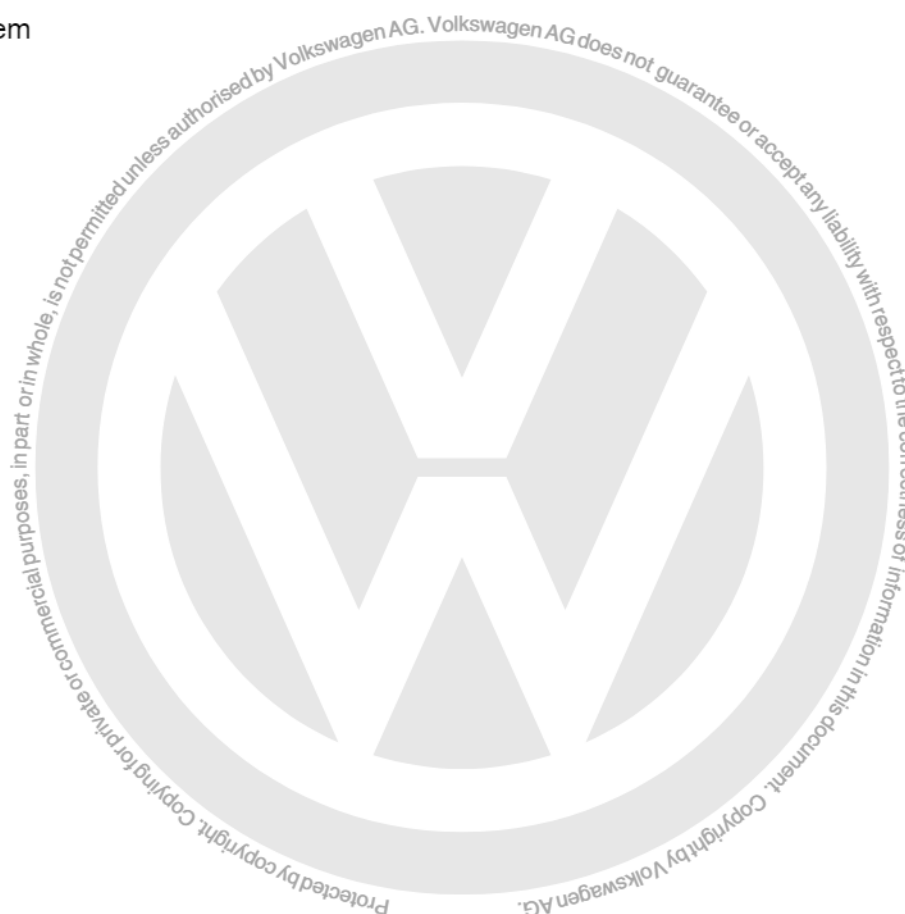




List of Workshop Manual Repair Groups

Repair Group

- 00 - Technical data
- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, valve gear
- 17 - Lubrication
- 19 - Cooling
- 20 - Fuel supply system
- 21 - Turbocharging/supercharging
- 23 - Mixture preparation - injection
- 26 - Exhaust system
- 28 - Ignition system



Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.



Contents

00 - Technical data	1
1 Technical data	1
1.1 Engine number	1
1.2 Engine characteristics	1
10 - Removing and installing engine	2
1 Engine - remove and install	2
1.1 Removal - recommendations	4
1.2 Engine - fasten to assembly stand	7
1.3 Installation notes	7
1.4 Tightening torques	8
1.5 Power-drive group supports, (torque)	8
1.6 Additional information and removal instructions for vehicles with air conditioning	9
13 - Crankshaft group	10
1 Engine - assembly and disassembly	10
1.1 Poly-V belt - remove and install	15
2 Crankshaft flanges and flywheel - remove and install	18
2.1 Oil crankshaft seal, pulley side - replace	19
2.2 Crankshaft seal flange - replace	21
3 Balance shaft and mounting frame - remove and install	24
3.1 Balance shaft - remove and install	26
4 Crankshaft - remove and install	30
4.1 Crankshaft dimensions	31
5 Pistons and bearing rods - disassemble and assemble	33
5.1 Piston and cylinder dimensions	37
15 - Cylinder head, valve gear	38
1 Cylinder head - remove and install	38
1.1 Toothed belt - remove and install, adjust	42
1.2 Cylinder head - remove and install	46
1.3 Compression - check	49
2 Valve command - repair	52
2.1 Camshaft - check axial clearance	54
2.2 Valve seat - trim	55
2.3 Valve guides - check	57
2.4 Valve stem seal - replace	57
2.5 Camshaft - remove and install	59
17 - Lubrication	64
1 Lubrication system components - remove and install	64
1.1 Oil pan - remove and install	71
1.2 Check the oil pressure and the oil pressure switch	72
19 - Cooling	75
1 Cooling system components - remove and install	75
1.1 Cooling system components on the body	75
1.2 Cooling system components in the engine	77
1.3 Hose connection diagram for cooling system	78
1.4 Cooling system - drainage and replenishment	79
1.5 Radiator - remove and install	82
1.6 Water pump - remove and install	83



1.7	Thermostat - remove and install	85
20	Fuel supply system	88
1	Fuel supply system components - removal and installation	88
1.1	Fuel tank components with accessories - remove and install	88
1.2	Fuel filter - repair	90
1.3	Safety measures for working on fuel supply system	92
1.4	Cleaning rules	92
1.5	Fuel reservoir - remove and install	93
1.6	Fuel pump - remove and install	95
1.7	Fuel gauge sensor - remove and install	96
1.8	Fuel pump - check	97
1.9	Accelerator mechanism - repair	98
1.10	Auxiliary pump - check	99
1.11	Auxiliary pump - remove and install	101
21	Turbocharging/supercharging	105
1	Supercharging system with turbocharger	105
1.1	Safety measures	105
1.2	Rules for cleaning	105
1.3	Turbocharger - remove and install	105
1.4	Intake air cooling system components (intercooler) - remove and install	108
23	Mixture preparation - injection	110
1	Direct injection Diesel system maintenance	110
1.1	Installation locations - overview	110
1.2	Safety measures	111
1.3	Cleaning rules	112
1.4	Intake manifold valve - repair	112
1.5	Injectors - repair	113
1.6	Injectors seal ring - remove and install	114
1.7	Nozzles - remove and install	115
2	Engine command unit	119
2.1	Engine command unit - remove and install	119
2.2	Check the event memory in the engine command unit and delete it	119
2.3	Adjust functions and components	121
26	Exhaust system	123
1	Exhaust system components - remove and install	123
2	Exhaust gases recirculation system	125
2.1	Exhaust gas recirculation system components - removal and installation	125
2.2	Vacuum hose connection diagram	126
28	Ignition system	127
1	Preheating system - check	127
1.1	Checking heating plugs	128



00 – Technical data

1 Technical data

(VRL013436; Edition 09.2019)

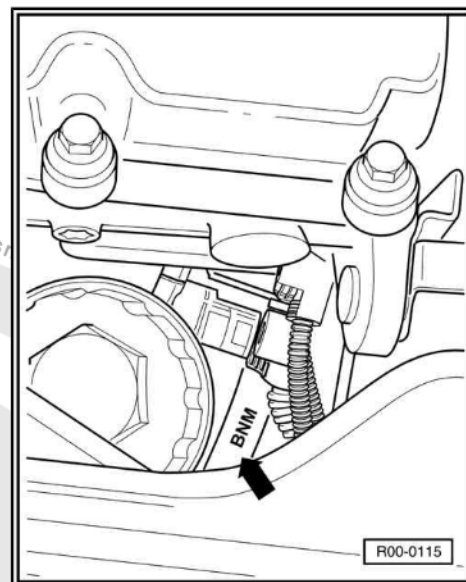
1.1 Engine number

The engine number ("identification letters" and "serial number") is engraved on the flange between the engine and the transmission.

The engine number is comprised of nine digits (alphanumeric) at most. The first part (max. of three identification letters) represents "the engine identification letters"; the second part (six characters) represents the "serial number". If more than 999,999 engines with the same engine codes are produced, the first of the six digits is replaced by a letter.

Additionally, there is a sticker -arrow- containing the "engine codes" and "series number" on the mechanical distribution cover.

The "engine identification letters" are also shown on the vehicle data plate.



1.2 Engine characteristics

Engine codes		BNM
Production		From 11.04 to 09.10
Cylinder volume	l	1.4
Output	kW/rpm	51/4000
Torque	Nm / rpm	155/1600 to 2800
Cylinder diameter	Ø mm	79.5
Stroke length	mm	95.5
Compression rate		19.5
Octane number	minimum	49
Firing sequence		1-2-3
Catalytic converter		yes
exhaust gas recirculation		yes
Supercharged		yes
Intercooler		yes



10 – Removing and installing engine

1 Engine - remove and install

Special tools and workshop equipment required

◆ Lifting tackle - 2024A-



◆ Mounting bracket - T10012-

◆ 700 - 1200Kg Crane - VAS 6100-



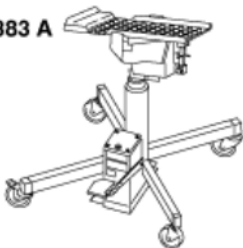
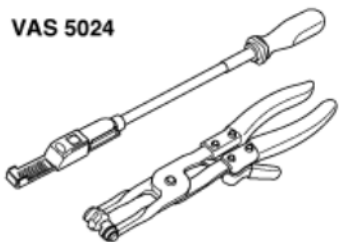

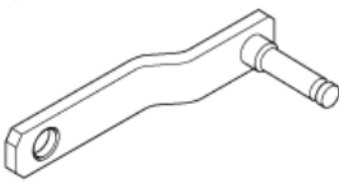


◆ Rotating engine and gearbox stand - VAS 6095-



◆ Drip tray - V.A.G 1306-

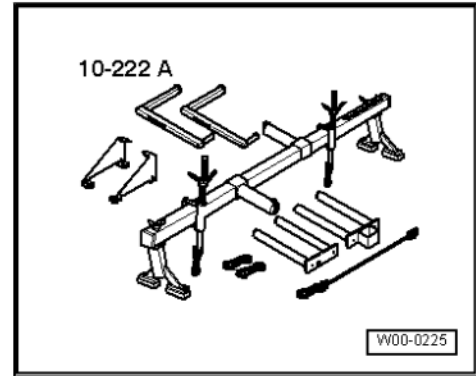


<p>V.A.G 1331</p> 	<p>V.A.G 1332</p> 
<p>V.A.G 1383 A</p> 	<p>VAS 5024</p> 
<p>VAS 5085</p> 	<p>3147</p>  <p>W10-0026</p>

- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Torque Wrench - 40 to 200 Nm (1/2" drive) - VAG 1332-
- ◆ Gearbox or engine/gearbox jack - VAG 1383A-
- ◆ Spring-type clip pliers - VAS 5024A-
- ◆ Portable ladder - VAS 5085-
- ◆ Mounting bracket - 3147-
- ◆ 3 washers A13 x 24 x 2.5
- ◆ 2 washers A10.5 x 21 x 2
- ◆ Cable tie



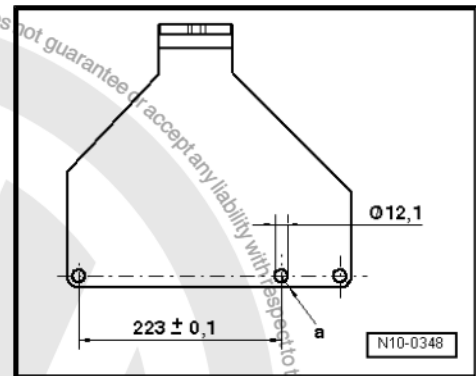
- ◆ Engine support bridge - 10-222A- with Support - 10-222A/1-



- ◆ Adapter - 10-222A/18-

Alter the Support - T10012-

- Case the modification was not yet made, drill an additional hole -a- in accordance with the given dimensions and aligned at the same height as the other holes.



1.1 Removal - recommendations



Note

- ◆ Check if the vehicle has a coded radio. If so, check the anti-theft code before disconnecting the mass cable from the battery.
- ◆ The engine is removed without the gearbox, from below.



WARNING

Remember the following when performing installation work, especially inside the engine compartment where there is little space:

- ◆ All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling fluid and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.
- ◆ Allow easy access to all the moving or hot parts.

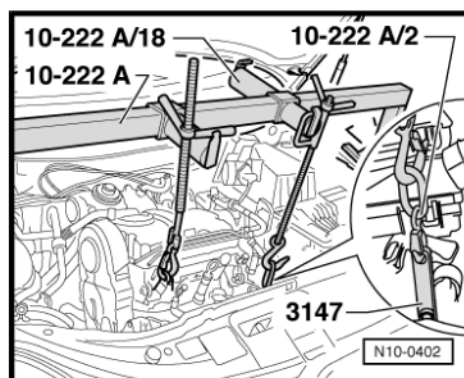
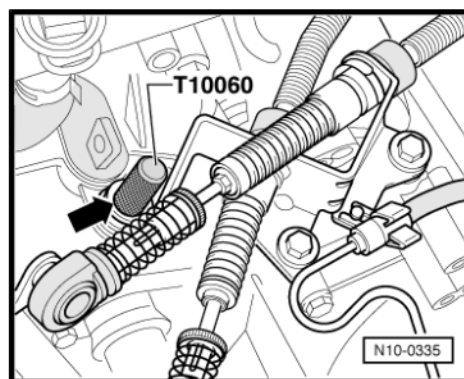
- With ignition off, disconnect earth strap from the battery.
- All cable clamps that open or break during engine removal must be replaced and installed in the same locations when engine is reinstalled.
- Loosen the supply and return hoses in the cylinder head.



WARNING

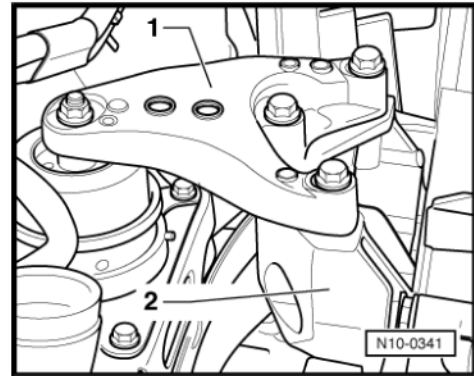
- ◆ *The fuel and the fuel hoses in the fuel system may become very hot (burn danger)!*
- ◆ *Fuel system is under pressure!*
- ◆ *Wear protection glasses and gloves to perform any kind of repairs in the fuel system!*

- Remove the hose between the intercooler and the intake flange.
- Remove the hose from the air mass gauge from the turbo-charger.
- Remove the lower engine noise insulation ⇒ Body - External assembly works; Rep. gr. 50 ; Body - front part
- Remove the hose between the intercooler and the turbocharg-er.
- Remove the Poly-V belt ⇒ [page 15](#) .
- Drain cooling system ⇒ [page 79](#) .
- Disconnect the hoses of the radiator cooling system from the engine using Hose clamp pliers - V.A.G 1921- or Spring-type clip pliers - VAS 5024A- .
- Remove/disconnect all necessary electric connections from the engine.
- Remove from the engine all hoses from the cooling, vacuum and intake system.
- Remove the fastening screw of the cable support and attach the clutch lever inserting a Pin - T10060- -arrow-
- Remove the fastening screws from the engine/transmission upper part.
- Remove the coolant tank.
- Loosen and move the start engine back, until the Support - 3147- can be inserted.
- Install the Support device - 10-222A- and support the engine and the transmission as shown in the diagram.





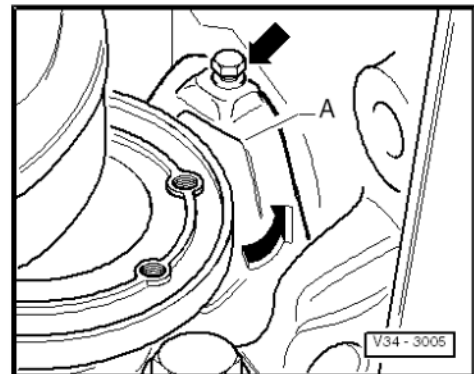
- Remove the engine support -1- and the engine console -2-.
- Disconnect the right drive shaft ⇒ Chassis, axles, steering; Rep. gr. 40 ; Front suspension .
- Remove the front exhaust pipe from the turbocharger. Release the double clamp and push the exhaust pipe back ⇒ [page 123](#) .



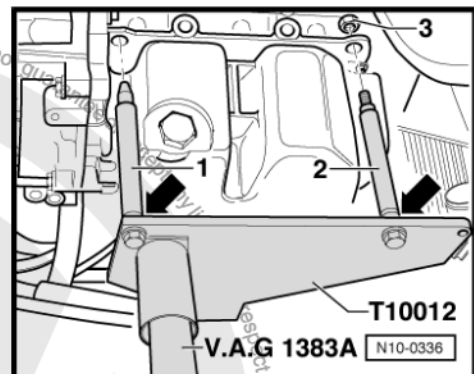
- Remove the protection plate behind the drive shaft flange.

Vehicles with air conditioning:

- Observe the additional information and removal instructions ⇒ [page 9](#) .



- Install to the engine the pin -1- with a washer and the pin -2- with two Washers A13 x 24 x 2.5 according to the illustration -arrows-.
- Attach the Support - T10012- with the nut -3- and the fastening screw of the compact support in the engine block.



Note

Put two Washers A10.5 x 21 x 2 between the engine support and the compact support so that the engine support is completely held by the compact support.

- Remove the fastening screws from the engine/transmission lower part.
- Slightly raise the engine and the transmission using the Gearbox or engine + gearbox set jack - VAG 1383A-
- Remove the Support - 10-222A- fuse from the engine side.



Note

Use the portable ladder - VAS 5085- to remove the fuse.

- Release the transmission motor, carefully lowering using the Gearbox or engine + gearbox assembly jack - VAG 1383A- and remove it from below.



Note

When lowering, drive the motor carefully to avoid damages to the body.



1.2 Engine - fasten to assembly stand

To carry out the installation work, the engine must be mounted on the Rotating engine and gearbox stand - VAS 6095-

Work sequence

- Fasten with the Lifting tackle - 2024A- as described below and raise it slightly with the Gearbox or engine + gearbox assembly jack - VAG 1383A- .

Pulley side: position -4- of the vertical rod. Orifice on the sustaining bar in position -1-.

Flywheel side: position -2- of the vertical rod. Orifice on the sustaining bar in position -8-.



WARNING

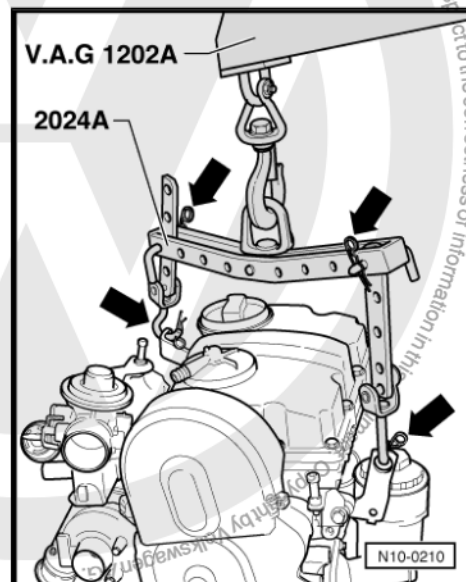
Use safety locks on the hooks and pins -arrows-.



Note

- ◆ *Positions numbered 1...4 on suspension bar are positioned toward the pulley.*
- ◆ *The holes in the supports are counted from the hook.*

- Fasten the engine to the Rotating engine and gearbox stand - VAS 6095- .



1.3 Installation notes

Installation is carried out in reverse sequence of the removal, considering the following:

- Check the clutch roller bearing for wear and replace if necessary.
- Lightly lubricate the clutch roller bearing and the primary shaft bearing guide sleeve with Lubricating grease - G 000 100- .
- Check that the guides for fixing the engine and gearbox are placed on the engine block and, if necessary, install them.
- Align the engine, moving it quickly so that the supports fit without tension.



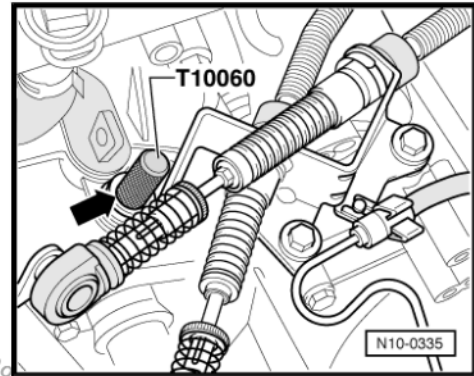
Note

Tightening torque for the assembly supports ⇒ [page 8](#) .

- Electric connections and installation ⇒ Electrical system; Rep. gr. 97 ; Wiring harnesses and cables :



- Remove the Pin - T10060- -arrow- and replace the fastening screw.
- Install the drive shaft ⇒ Chassis, axles, steering; Rep. gr. 40 ; Front suspension .
- Install front exhaust pipe ⇒ [page 123](#) .
- Install Poly-V belt ⇒ [page 15](#) .
- Install the intake air filter/turbocharger, intercooler/turbocharger and intercooler/flange hoses.
- Replenish cooling system ⇒ [page 79](#) .
- Install the lower engine noise insulation ⇒ Body - External assembly works; Rep. gr. 50 ; Body - front part .
- Carry out a test drive and check the event memory ⇒ [page 119](#) .



1.4 Tightening torques

Assignment		Tightening torque
Bolts, nuts	M 6	10 Nm
	M 8	20 Nm
	M 10	45 Nm
	M 12	60 Nm
Different tightening torques		
Front exhaust pipe and turbocharger		25 Nm

1.5 Power-drive group supports, (torque)



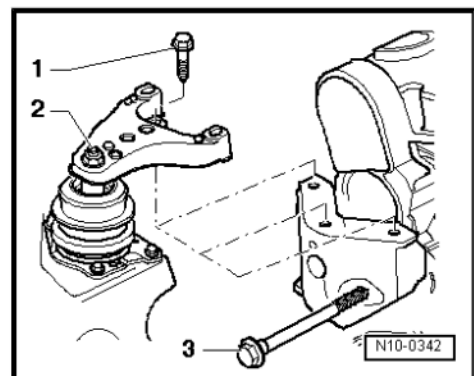
WARNING

Always replace self-locking nuts and bolts subject to angular torque

Tightening torques

Power-drive unit supports (engine side):

- 1 - ¹⁾ = 30 Nm + 90°.
 - 2 - ¹⁾ = 40 Nm + 90°.
 - 3 - 45 Nm.
- 1) Renew.





1.6 Additional information and removal instructions for vehicles with air conditioning



Note

- ◆ *The air conditioning refrigerant line circuit needs to be open to remove the engine.*
- ◆ *To avoid damage to the condenser and cooling gas hoses, do not kink, twist nor overstretch the hoses.*
- Remove the air conditioning compressor and anchor it to the body. ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning
- Purge the air conditioning refrigerant line circuit and open the gas circuit ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .



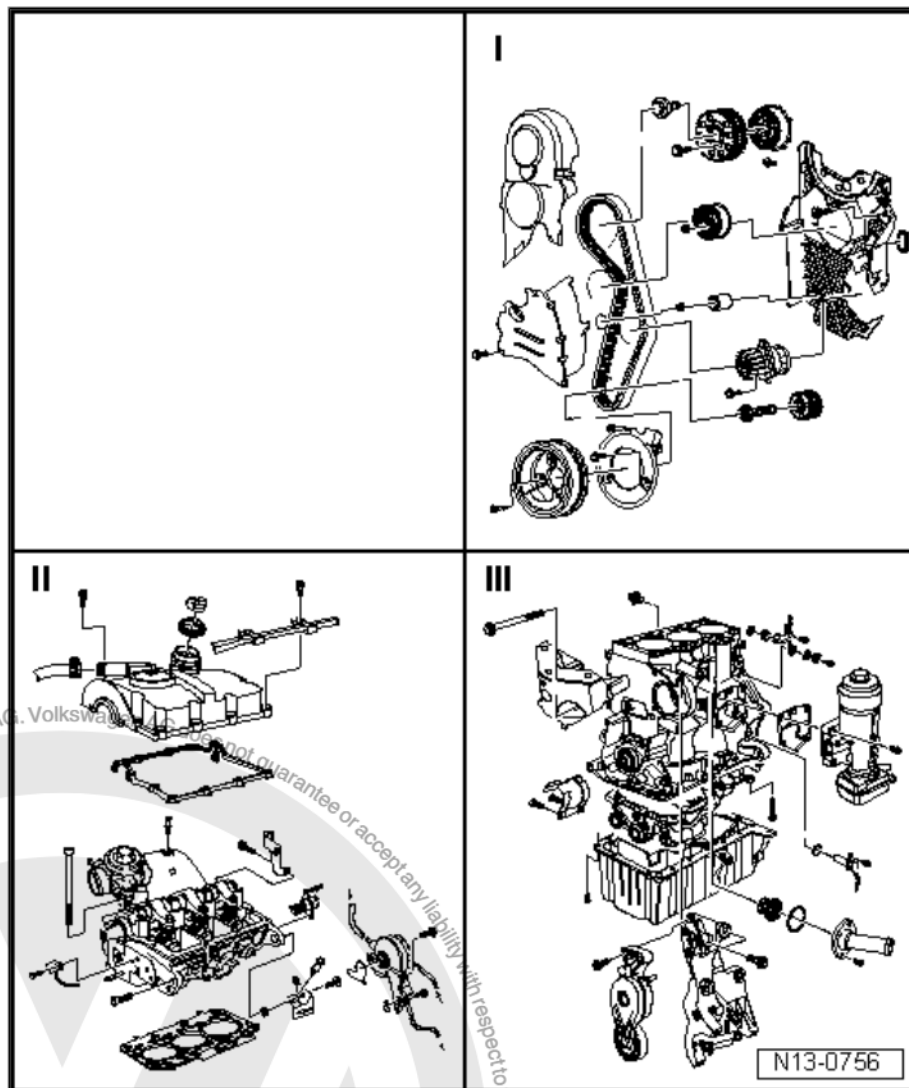
Note

The air conditioning compressor may be fixed in place.



13 – Crankshaft group

1 Engine - assembly and disassembly



Note

- ◆ When significant quantities of metal chips and filings appear in the engine oil during repair due to crankshaft and rod bearing wear, the oil filter must be replaced and the oil grooves must be carefully cleaned.
- ◆ All bearing or sliding surfaces should be lubricated before assembly.



WARNING

Always replace self-locking nuts and bolts subject to angular torque



I ➤ [page 11](#)

II ➤ [page 12](#)

III ➤ [page 13](#)

Part I

1 - Upper part of the cover of the toothed belt

2 - Toothed belt

- ☐ Mark rotation direction before removal.
- ☐ Check for wear.
- ☐ Do not bend.
- ☐ Removal, installation and adjustment ➤ [page 42](#).

3 - 20 Nm + 45°

- ☐ Renew after each removal.

4 - Toothed belt tensioning pulley

5 - 100 Nm

6 - 25 Nm

7 - Camshaft gear

8 - Pulley

- ☐ With engine speed sensor.
- ☐ Immobilize with Counterhold tool - T10051- to loosen or tighten.
- ☐ For such, use the Extractor - T10052-.
- ☐ Remove and install ➤ [page 59](#).

9 - 10 Nm

10 - Mechanical distribution rear cover

11 - Seal

- ☐ Replace it if damaged.

12 - Pulley

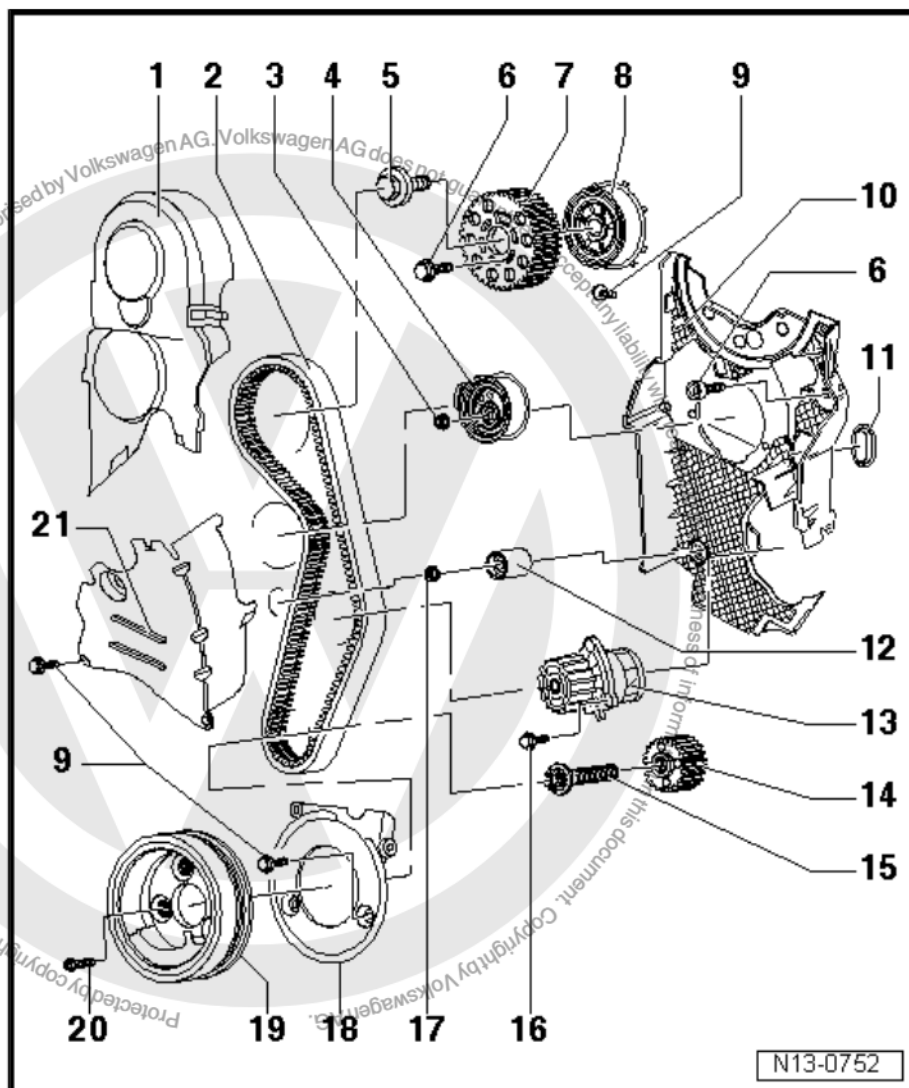
13 - Water pump

- ☐ Remove and install ➤ [page 83](#).

14 - Crankshaft gear

15 - 120 Nm + 90°

- ☐ Renew after each removal.
- ☐ Immobilize with Lock - 3415- to loosen or tighten.
- ☐ Do not lubricate or grease thread and bearing recesses/flange additionally.
- ☐ The angular torque can be performed in several stages.



N13-0752



16 - 15 Nm

17 - 20 Nm

18 - Lower part of the cover of the mechanical distributor

19 - Vibration damper pulley

- ☐ It can only be installed in one position. The holes are out of place.

20 - 10 Nm + 90°

- ☐ Renew after each removal.

21 - Central part of the cover of the toothed belt

Part II

1 - Cylinder head cover

- ☐ With oil filling nozzle.
- ☐ Replace the oil filling nozzle if the cylinder head lid is damaged.
- ☐ Before assembly, completely clean the cylinder head lid sealing surface with a clean cloth.

2 - For the turbocharger

3 - 10 Nm

- ☐ First, manually tighten all screws.
- ☐ After that, tighten the upper and the rest of the screws from the inside to the outside, diagonally, according to the specified torque.

4 - Pressure regulating valve

- ☐ For the crankcase vent.

5 - Cap

- ☐ Replace the seal, if damaged.

6 - Gasket

- ☐ Replace it if damaged.

7 - Oil filling nozzle

- ☐ Renew.

8 - Mounting bracket

- ☐ With fuel line.

9 - Cylinder head cover gasket

- ☐ Replace it if damaged.

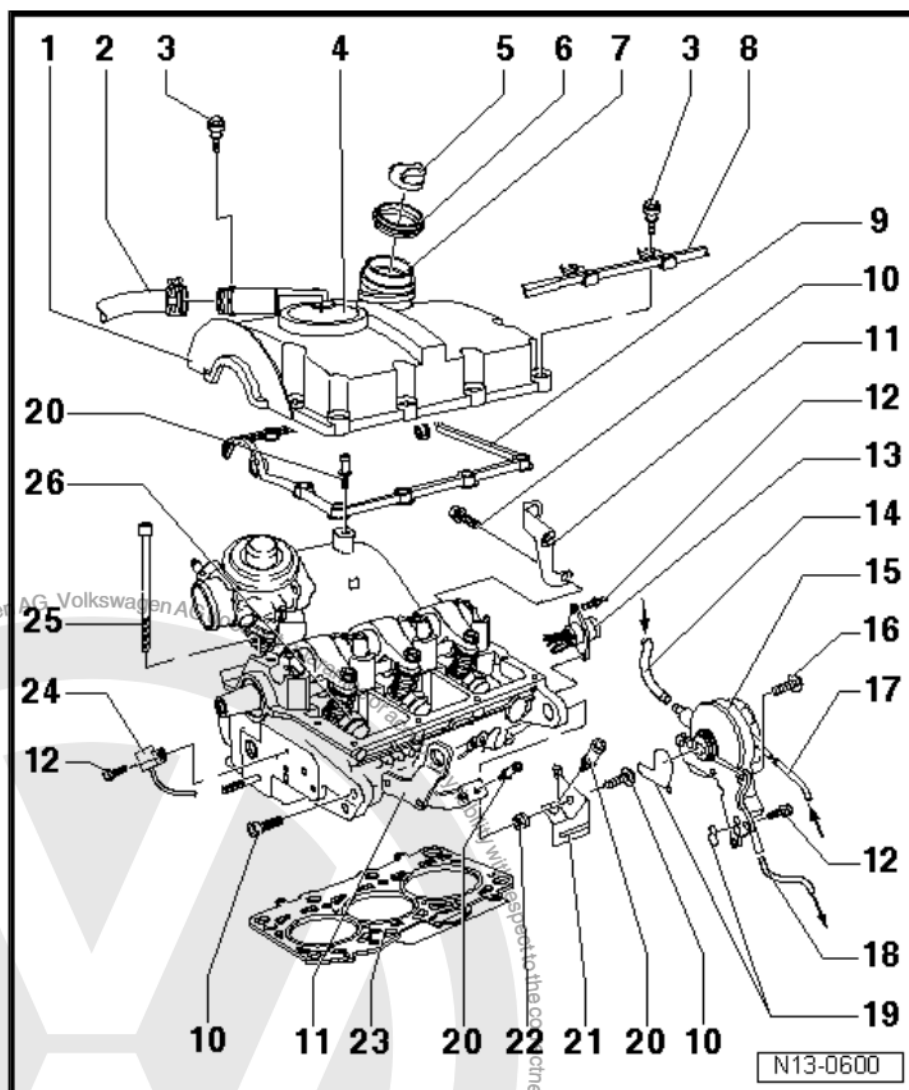
10 - 20 Nm

11 - Suspension eyelet

12 - 10 Nm

13 - Central connector

- ☐ For the injector.





14 - For brake servo

15 - Tandem Pump

- ☐ To supply fuel and vacuum.
- ☐ Remove and install ⇒ [page 101](#) .
- ☐ Check ⇒ [page 99](#) .

16 - 25 Nm

17 - Supply hose

- ☐ From the fuel filter ⇒ [Item 1 \(page 91\)](#) .
- ☐ White or white-marked.
- ☐ Check that it is firmly installed.
- ☐ Fasten with spring braces.

18 - Return hose

- ☐ To the fuel filter ⇒ [Item 1 \(page 91\)](#) .
- ☐ Blue or blue-marked.
- ☐ Check that it is firmly installed.
- ☐ Fasten with spring braces.

19 - Gasket

- ☐ Renew.

20 - Pin, 10 Nm

- ☐ For engine cover.

21 - Mounting bracket

22 - Hex nut

23 - Cylinder head gasket

- ☐ Renew.
- ☐ Check the identification ⇒ [page 37](#) .
- ☐ When replacing, replace all coolant.

24 - Hall Sender - G40-

- ☐ To the camshaft position.
- ☐ Loosen to remove the insulating ring from the rear mechanical distribution cover.

25 - Cylinder head fastening screw

- ☐ Renew.
- ☐ Follow the sequence for removal and installation ⇒ [page 46](#) .
- ☐ Insert the washers inside the cylinder heads before installing ⇒ [Item 4 \(page 52\)](#) .

26 - Injectors

- ☐ Remove and install ⇒ [page 115](#) .

Part III



WARNING

Always replace self-locking nuts and bolts subject to angular torque



1 - 45 Nm

2 - Engine support

3 - Cylinder block

- ☐ Remove and install the sealing flange and the engine steering
⇒ [page 18](#) .
- ☐ Disassemble and assemble the pistons and connecting rods
⇒ [page 33](#) .

4 - Connection, 40 Nm

- ☐ For the turbocharger oil return line.
- ☐ Renew.

5 - Spacer sleeve

6 - Rubber bushing

7 - Mounting bracket

- ☐ For the Sensor Hall G40- connector of the camshaft position and Engine speed sensor - G28- .

8 - 10 Nm

9 - Gasket

- ☐ Renew.

10 - Oil filter bracket

- ☐ Remove and install
⇒ [page 67](#) .

11 - 15 Nm + 90°

- ☐ Renew after each removal.

- ☐ First, attach the screws left on the upper part, and on the lower part on the right. Then, tighten the four screws diagonally.

12 - Seal

- ☐ Renew.

13 - 20 Nm

14 - Engine speed sensor - G28-

15 - Connection

- ☐ For the temperature sensor.

16 - 15 Nm

17 - Coolant temperature sensor

- ☐ Remove and install ⇒ [page 85](#) .

18 - 45 Nm

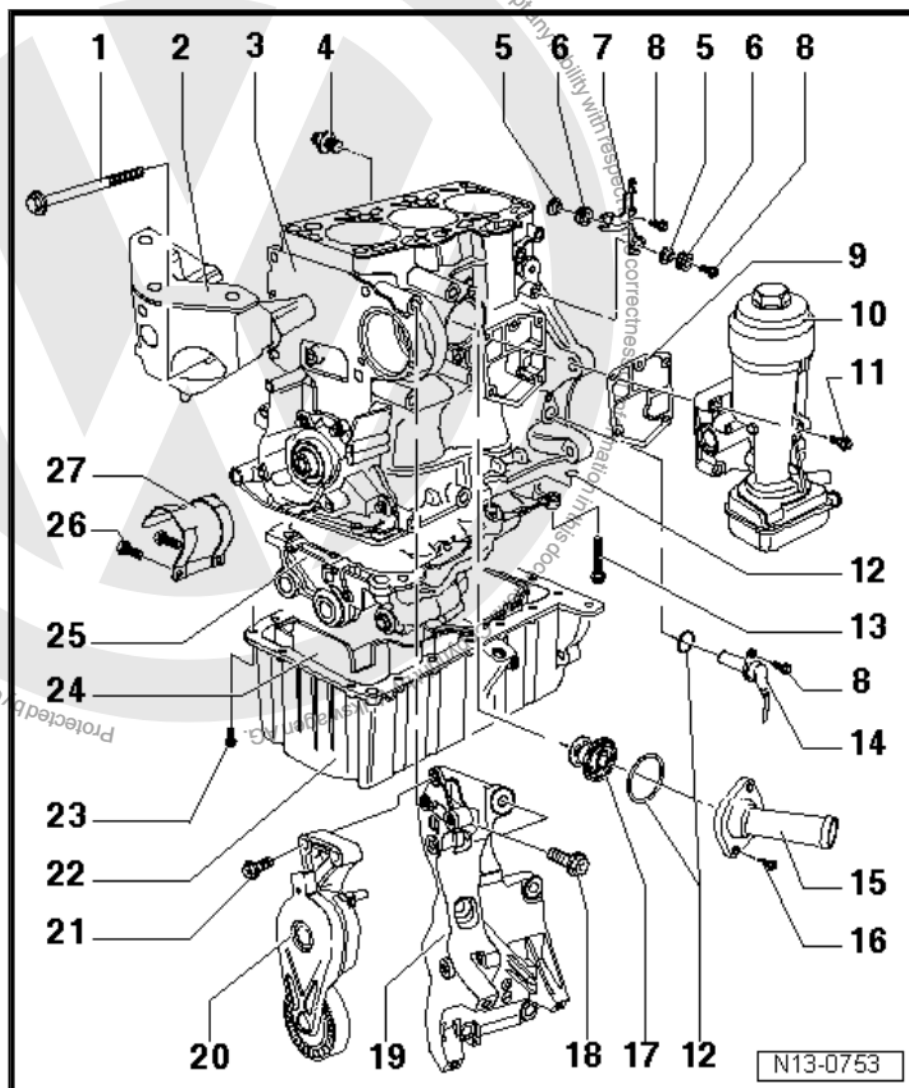
- ☐ Tightening sequence: inside out.

19 - Compact support

- ☐ For the generator, air conditioning compressor and Poly-V Belt tensioner.
- ☐ Check the location guide between the compact support and the engine block.

20 - Tensor

- ☐ To Poly-V belt.





21 - 25 Nm

22 - Crankcase

- ☐ Clean the sealing surfaces before installation.
- ☐ Install with Silicone sealant - D 176 404 A2- ➔ [page 71](#) .
- ☐ To remove the oil pan, first remove the gearbox ➔ Clutch and gearbox; Rep. gr. 34 ; Drive, housing .

23 - 15 Nm

- ☐ To remove the rear screws near the gearbox, the gearbox needs to be removed ➔ Clutch and gearbox; Rep. gr. 34 ; Drive, housing .

24 - Cover

- ☐ With sealing tape.
- ☐ Clean the filter, if dirty.

25 - Mounting frame

- ☐ Before installing, check that the mounting guides for centralization on the engine block are in place and that the fuel distribution ring is inserted in the mounting frame.
- ☐ Remove and install ➔ [page 24](#) .

26 - 40 Nm

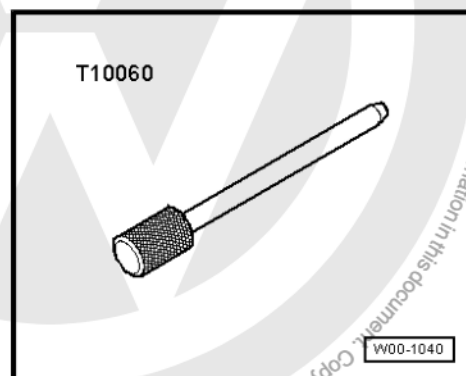
27 - Protection cap

- ☐ For the drive shaft.

1.1 Poly-V belt - remove and install

Special tools and workshop equipment required

- ◆ Retaining pin - T10060 A-



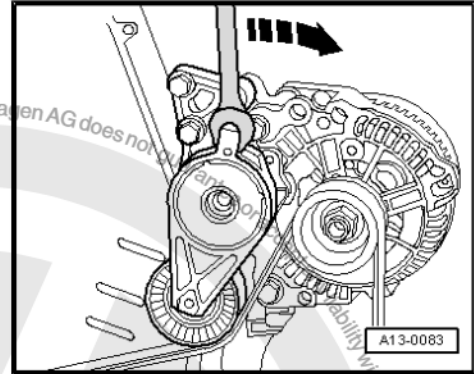
- ◆ 15 mm AF wrench

1.1.1 Removal

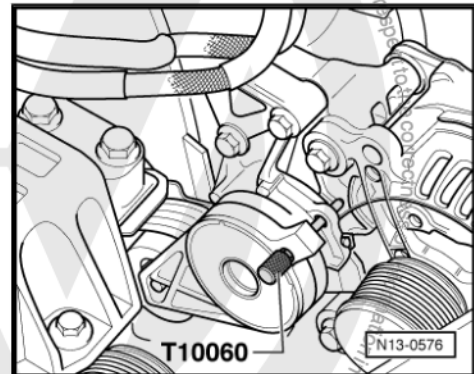
- Remove the lower noise insulation from the engine ➔ Body - External assembly works; Rep. gr. 50 ; Body - front part .
- Remove the hose between the intake intercooler/flange and the air mass gauge.
- Mark the Poly-V belt working direction.



- Turn the tensioner in the direction of the arrow to relieve the Poly-V belt tension.



- Lock the tensioner with the Check pin - T10060A- .
- Remove the Poly-V belt.



1.1.2 Installation

- Installation is performed in reverse to removal sequence.



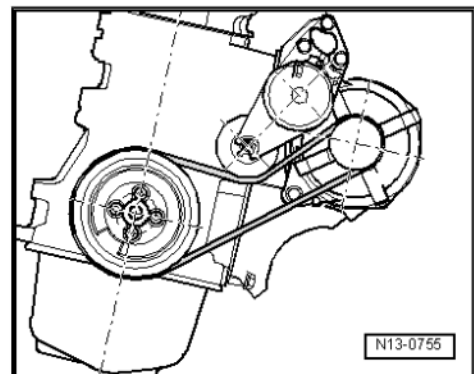
Note

- ♦ Check that before installing the Poly-V belt every auxiliary component (generator, air conditioning compressor) is firmly attached.
- ♦ When installing the Poly-V belt, observe the working direction and check the correct seating on the pulley.
- ♦ For vehicles without air conditioning, install the Poly-V belt on the generator last.
- ♦ For vehicles with air conditioning, install the Poly-V last on the air conditioning compressor pulley.

When the job is finished, always:

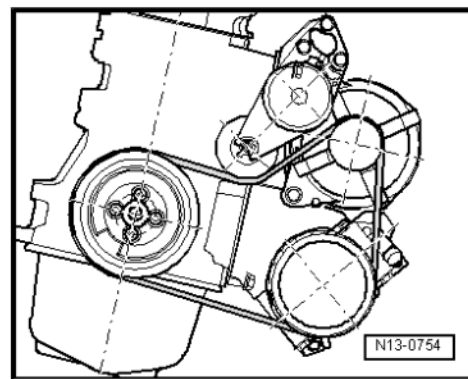
- Start the engine and check the belt motion.

Path of the belt for vehicles without air conditioning.





Path of the belt for vehicles with air conditioning.





2 Crankshaft flanges and flywheel - remove and install



WARNING

Always replace self-locking nuts and bolts subject to angular torque



Note

Clutch repairs: ➔ Clutch and gearbox; Rep. gr. 30 ; Clutch - command system .

1 - Oil Seal

- ☐ Do not additionally lubricate or grease the seal lip.
- ☐ Before installation, remove oil residues from crankshaft journal with a clean cloth.
- ☐ Replace oil crankshaft seal on the pulley side ➔ [page 19](#) .

2 - Sealing flange

- ☐ It needs to be positioned on the mounting guides.
- ☐ Remove and install ➔ [page 21](#) .
- ☐ Install with Silicone sealant - D176404 A2- ➔ [page 21](#) .

3 - Cylinder block

- ☐ Remove and install the crankshaft ➔ [page 30](#) .
- ☐ Disassembly and assembly of the pistons and connecting rods ➔ [page 33](#) .

4 - Flywheel

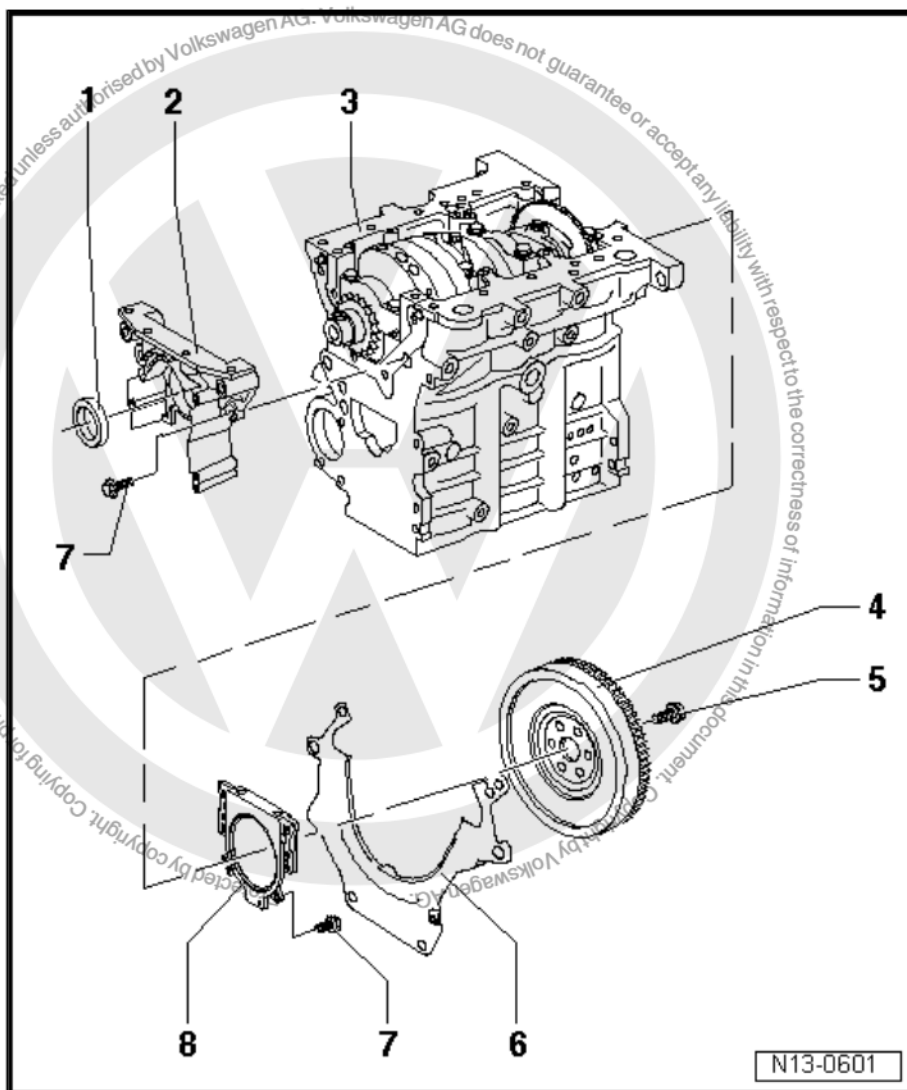
- ☐ To remove and install the flywheel, immobilize with a Flywheel Lock - 3386- .

5 - 60 Nm + 90°

- ☐ Renew after each removal.

6 - Intermediate plate

- ☐ It needs to be positioned on the mounting guides.
- ☐ Do not damage/bend during installation.



N13-0601



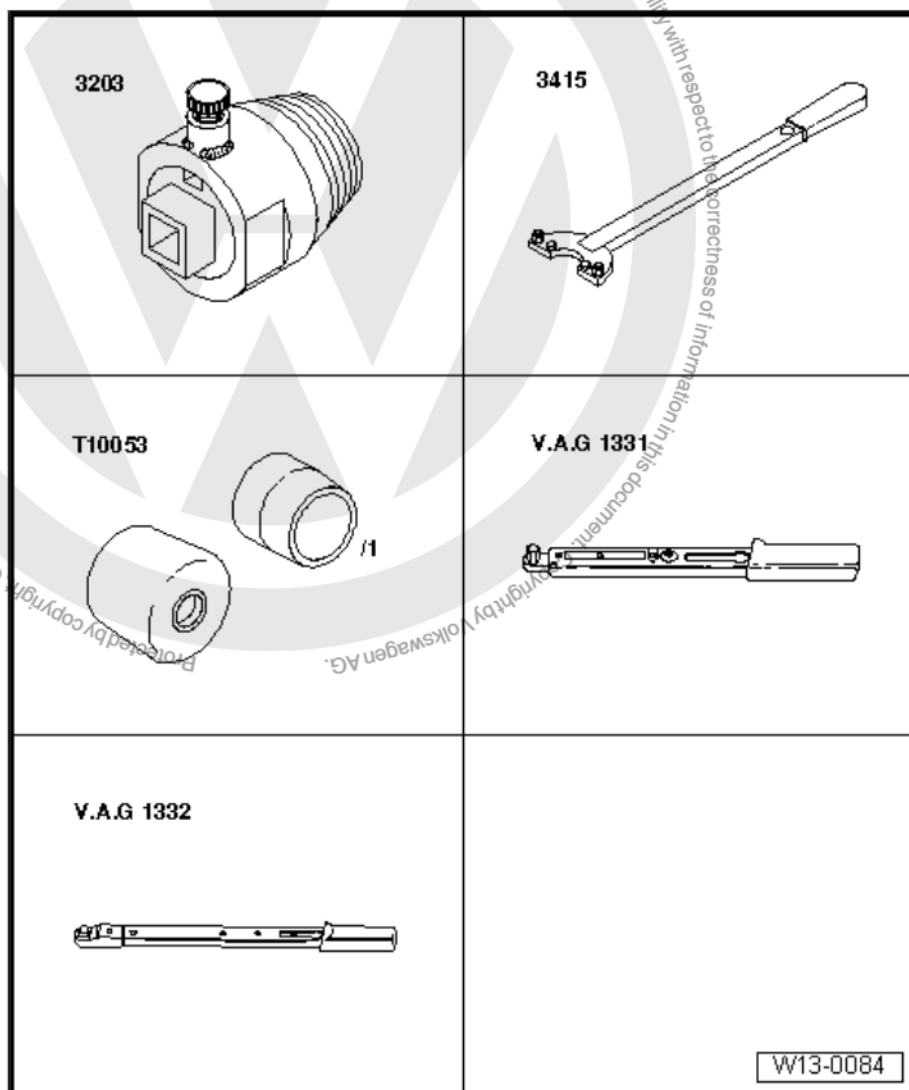
7 - 15 Nm

8 - Seal flange with seal

- ☐ Replace only completely.
- ☐ Do not additionally lubricate or grease the seal lip.
- ☐ Before installation, remove oil residues from crankshaft trunnion with a clean cloth.
- ☐ Use protection glove provided when installing.
- ☐ First remove the protection glove after the seal flange has been installed on the crankshaft journal.

2.1 Oil crankshaft seal, pulley side - replace

Special tools and workshop equipment required

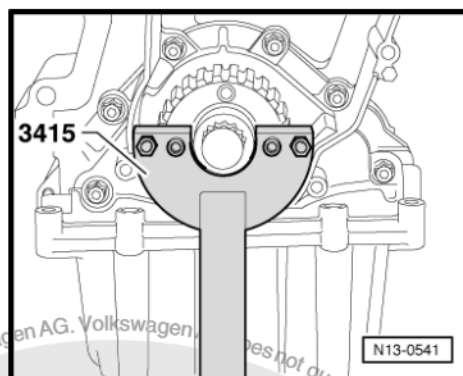


- ◆ Puller - 3203-
- ◆ Immobiliser - 3415-
- ◆ Assembly sleeve - T10053-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Torque Wrench - 40 to 200 Nm (1/2" drive) - VAG 1332-

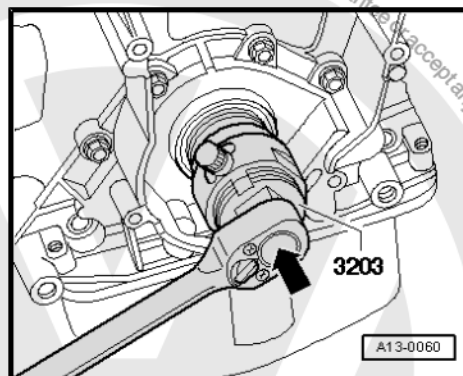


2.1.1 Removal

- Remove the Poly-V belt ➔ [page 15](#) .
- Remove toothed belt ➔ [page 42](#) .
- Remove crankshaft gear. For this purpose, immobilize the gear with the Lock - 3415- .
- To guide the seal Extractor - 3203- , manually install the gear fastening screw to the crankshaft stop.
- Turn the inner part of the Extractor - 3203- twice (approx. 3 mm) from the external part, and lock it with the splined screw.



- Lubricate the Puller - 3203- threaded head, seat it and screw it applying as much force to the seal as possible.
- Loosen the splined bolt and turn the inner part against the crankshaft until the seal is extracted.



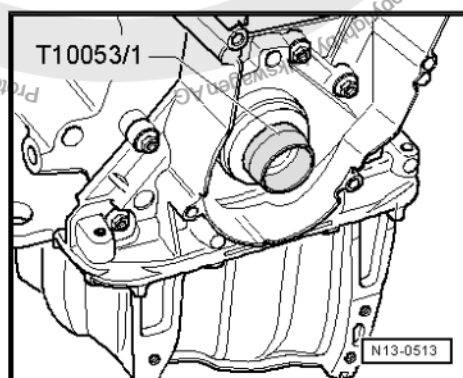
2.1.2 Installation



Note

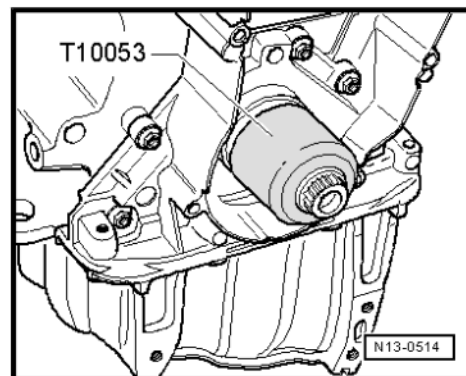
The oil seal sealing lip should not be additionally lubricated or greased.

- Before installation, remove oil residues from crankshaft trunnion with a clean cloth.
- Adjust the Guide sleeve - T10053/1- on the crankshaft journal.
- Slide the oil seal on the Guide sleeve - T10053/1- towards above the crankshaft edge.



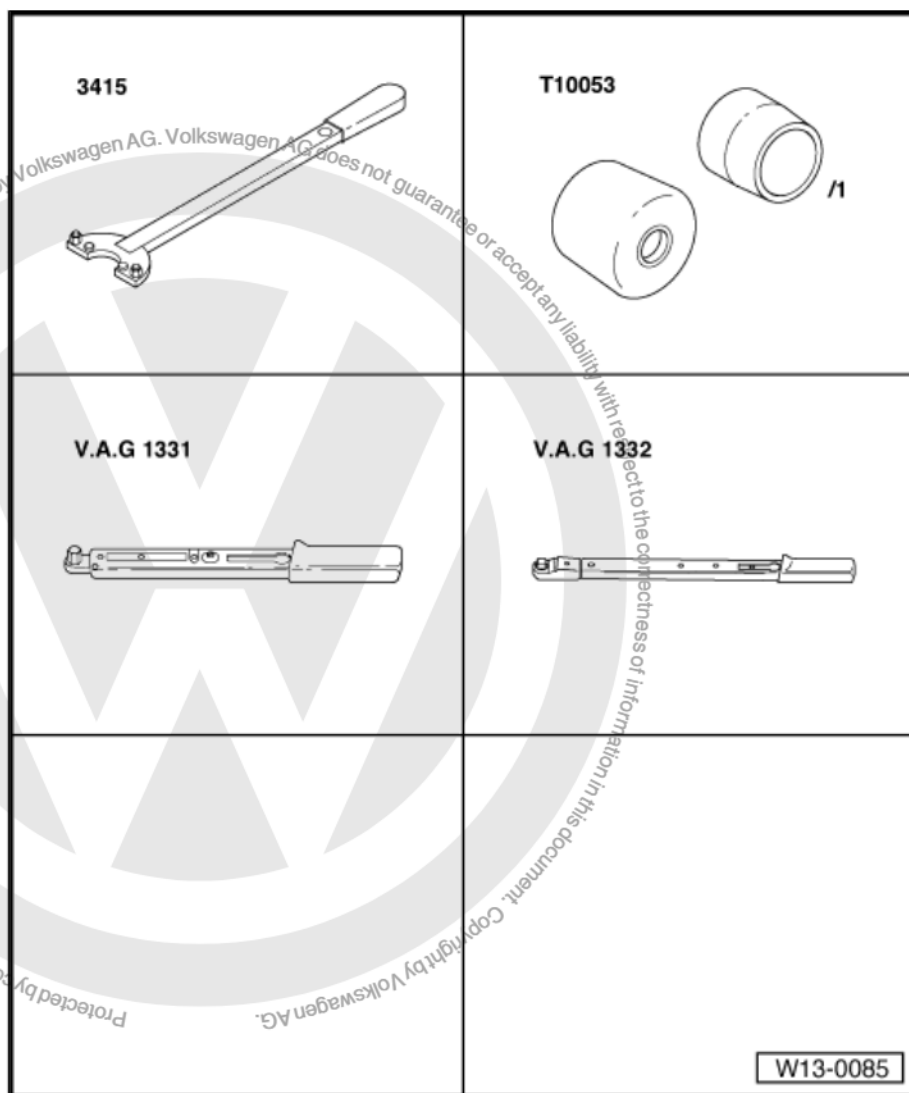


- Compress the seal to the stop using Clamping Sleeve of the Assembly sleeve - T10053- and the Central screw - T10053/2 - or Central screw - T10053/3- .
- Install and adjust the toothed belt ⇒ [page 42](#) .



2.2 Crankshaft seal flange - replace

Special tools and workshop equipment required



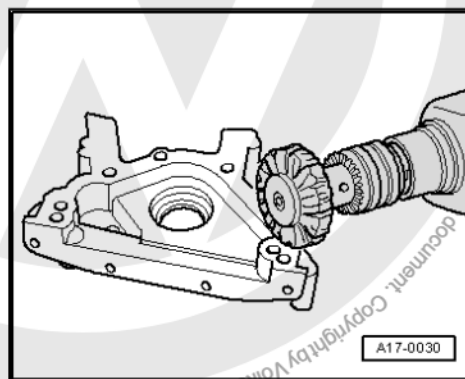
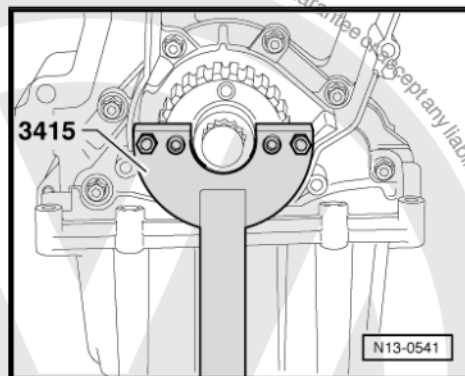
- ◆ Immobiliser - 3415-
- ◆ Assembly sleeve - T10053-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Torque Wrench - 40 to 200 Nm (1/2" drive) - VAG 1332-
- ◆ Portable drilling machine with plastic brush



- ◆ Silicone sealant - D176404 A2-
- ◆ Flat spatula

2.2.1 Removal

- Remove the Poly-V belt ➔ [page 15](#) .
- Remove toothed belt ➔ [page 42](#) .
- Remove crankshaft gear. For this purpose, lock the gear with the Lock - 3415- .
- Drain engine oil.
- Remove the oil sump ➔ [page 71](#) .
- Release the front seal flange.
- Remove the seal flange; release by slightly tapping it with a rubber hammer, if necessary.
- Remove seal residues from the engine block with a flat spatula.
- Cover the seal with a clean cloth.
- Remove the residues from the seal flange sealant with a rotary plastic brush (use protection glasses).
- Clean the sealing surfaces. They must be free of oil and grease.



2.2.2 Installation



Note

- ◆ Check the sealant expiry date.
- ◆ The seal flange should be installed within 5 minutes after applying the sealant.



- Cut the cartridge nozzle at the foremost marking (\varnothing of nozzle to be approx. 3 mm).
- Apply the silicone sealant as illustrated on the clear sealing surface of the seal flange. The sealing cord should:
 - ◆ Present a thickness of -arrows-: 2...3 mm.



Note

- ◆ *The sealant cord cannot be thicker or the excessive sealant can go to the oil pan and obstruct the oil suction line sieve as well as drain on the sealing surface of the crankshaft oil seal.*
- ◆ *Before applying the sealant, cover the oil seal with a clean cloth.*

- Attach the sealing flange immediately and slightly tighten all screws.



Note

Use the Guide glove - T10053/1- to fit the seal flange with the oil seal already installed.

- Tighten the fastening screws of the seal flange using an alternate sequence. Tightening torque: 15 Nm.
- Remove the excessive sealant.
- Install the oil pan ⇒ [page 71](#).

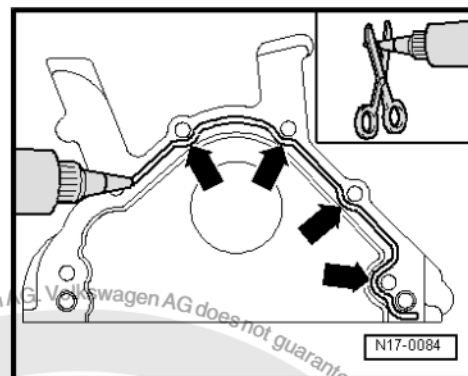


Note

After installation, the seal should dry for approximately 30 minutes before refilling the engine with oil.

Install toothed belt and adjust distribution times ⇒ [page 42](#).

- Install Poly-V belt ⇒ [page 15](#).





3 Balance shaft and mounting frame - remove and install



WARNING

Always replace self-locking nuts and bolts subject to angular torque



Note

All bearing or sliding surfaces should be lubricated before assembly.

1 - Chain

- ☐ Observe fixing position
⇒ page 26.

2 - 100 Nm + 90°

- ☐ Renew after each removal.
- ☐ The angular torque can be performed in several stages.
- ☐ To loosen and tighten, use a Multi-point wrench - T10061 -.

3 - Balance

- ☐ It can only be installed in one position. The holes are out of place.

4 - Gear

- ☐ For the balance shaft.
- ☐ It can only be installed in one position. The holes are out of place.

5 - Fastening sleeve

6 - 20 Nm + 90°

- ☐ Renew after each removal.

7 - Gear

- ☐ For the oil pump.
- ☐ It can only be installed in one position. The holes are out of place.

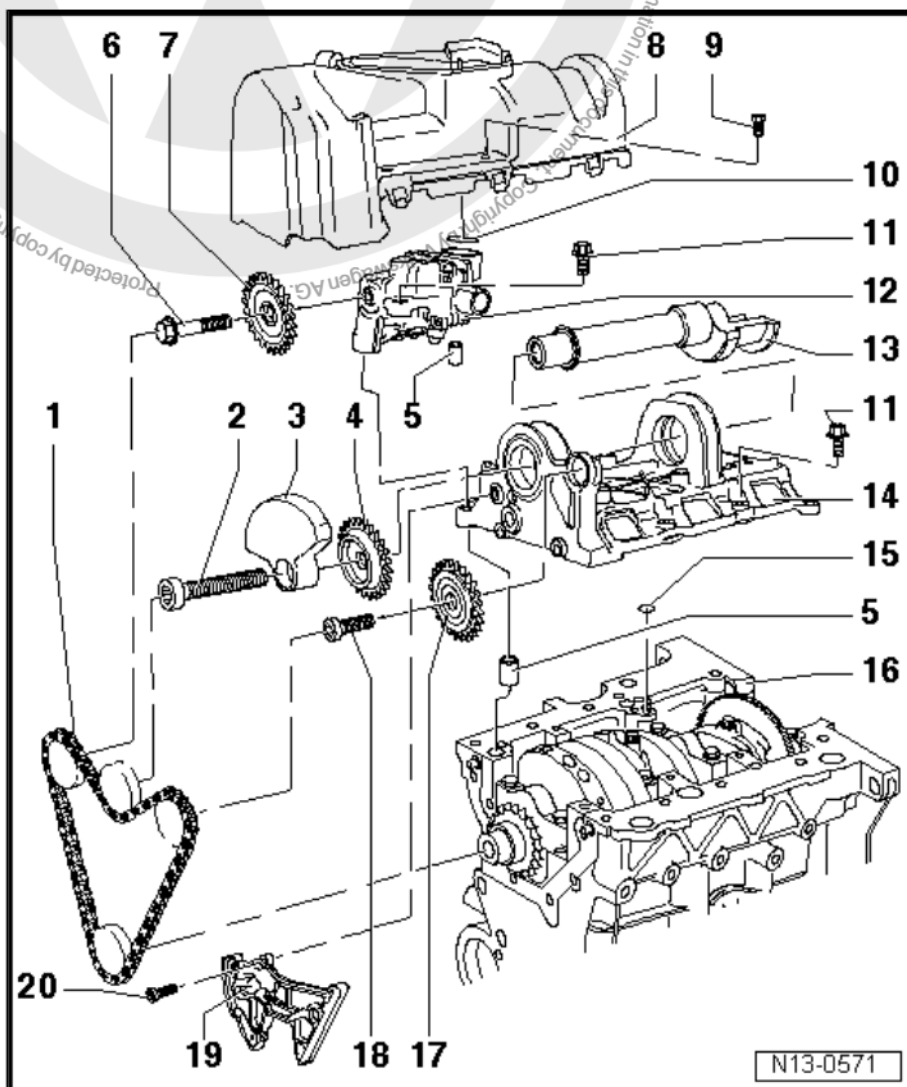
8 - Cover

- ☐ With sealing tape.
- ☐ Clean the filter, if dirty.

9 - 5 Nm

10 - Seal

- ☐ Renew.
- ☐ Check that it is firmly seated.



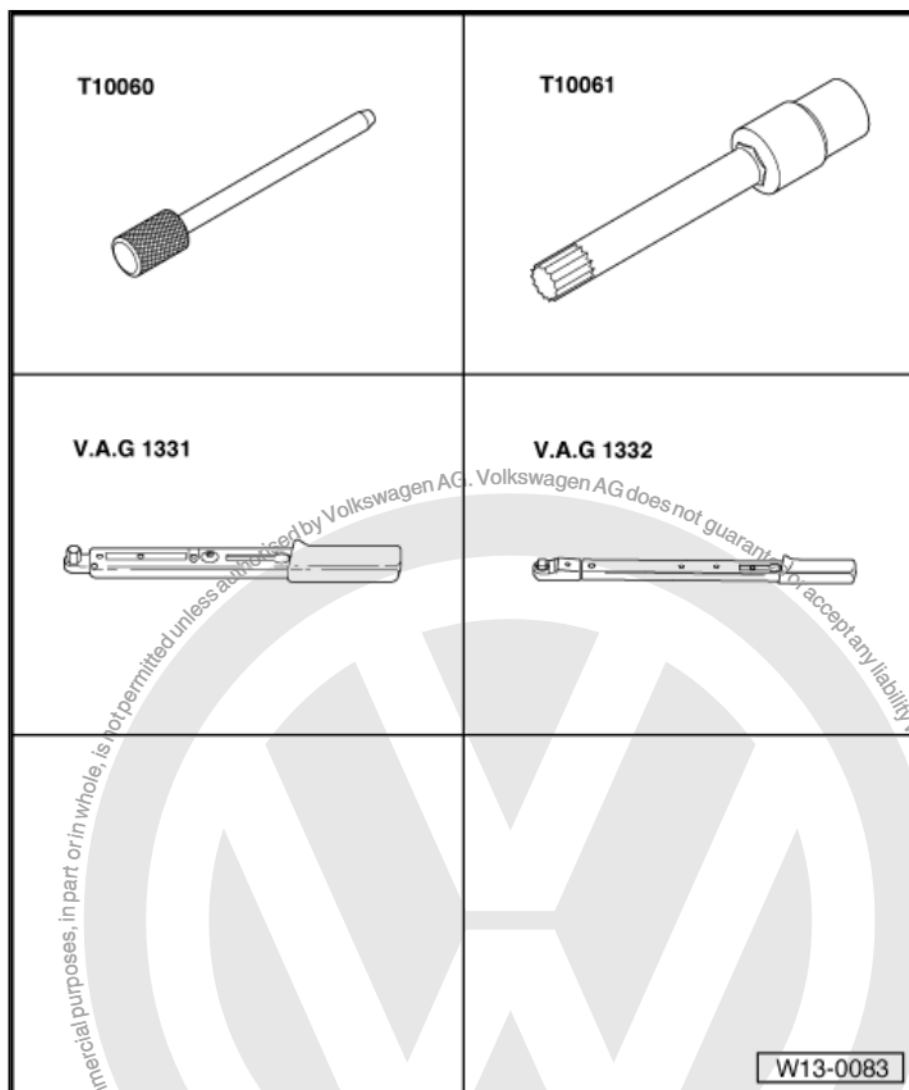


- ☐ Slightly lubricate when installing.
- 11 - 20 Nm
- 12 - Oil pump
 - ☐ With 11.5 bar pressure relief valve.
 - ☐ Before installing, check that both centralization gommets are installed.
- 13 - Balance shaft
 - ☐ Remove and install ⇒ [page 26](#) .
- 14 - Mounting frame
 - ☐ Before installing, check that the grommets for centralization on the engine block are in place and that the seal ring is inserted in the mounting frame.
 - ☐ Remove and install ⇒ [page 26](#) .
- 15 - Seal
 - ☐ Renew.
 - ☐ Check that it is firmly seated on the mounting frame.
- 16 - Cylinder block
- 17 - Gear
- 18 - 20 Nm
- 19 - Chain tensioner with spring clamping plate
 - ☐ To remove, immobilize with a Pin - T10060- .
 - ☐ Remove and install ⇒ [page 26](#) .
- 20 - 8 Nm + 90°
 - ☐ Renew after each removal.



3.1 Balance shaft - remove and install

Special tools and workshop equipment required



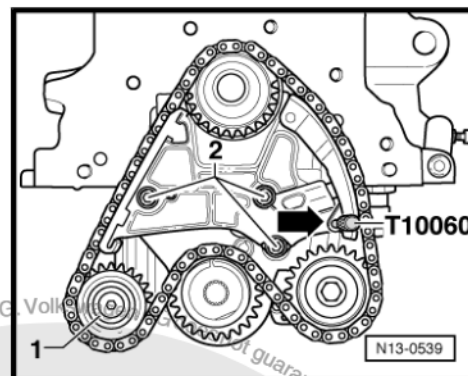
- ◆ Pin - T10060-
- ◆ Multi-point wrench - T10061-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Torque Wrench - 40 to 200 Nm (1/2" drive) - VAG 1332-
- ◆ Wrench (24/27 mm AF)

3.1.1 Removal

- Remove the Poly-V belt ⇒ [page 15](#) .
- Remove toothed belt ⇒ [page 42](#) .
- Remove the oil sump ⇒ [page 71](#) .
- Remove the seal flange, pulley side ⇒ [page 18](#) .
- Remove the cover fastening screws.
- Remove the cover from the mounting frame.



- Immobilize the chain tensioner with the Pin - T10060-arrow-.
- Loosen the gear-1- from the mounting frame.
- Remove the fastening screw -2- from the chain tensioner and remove it.
- Remove the chain and put it on a clean surface.



- Immobilize the balance shaft as shown with a Wrench (24/27 mm AF) -1-.



Note

When immobilizing the balance shaft, check that the key is centered in the balance shaft and in a straight angle in relation to the balance shaft.

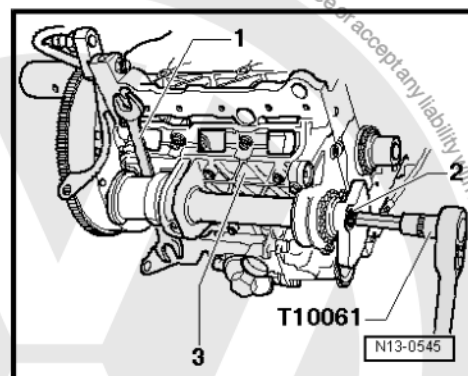
- Loosen the balance shaft fastening screw -2-.



Note

Loosen the balance shaft fastening screw -2-.

- Release the mounting frame -3- from the engine block and remove the mounting frame with the balance shaft.
- Put the mounting frame on a clean surface.
- Remove the fastening screws of the balance.
- Remove the balance and the balance shaft gear.
- Turn the balance shaft in a way that it can be removed from the bearing.



3.1.2 Installation

- Bearing oil sliding surfaces.
- Position the bearing balance shaft.
- Attach the gear and the balance to the balance shaft gear.



Note

The gear and balance installation is only possible in a single position.

- Manually tighten the fastening screw to the balance and gear.
- Tighten the mounting frame to the engine block manually so that there is no gap.



Note

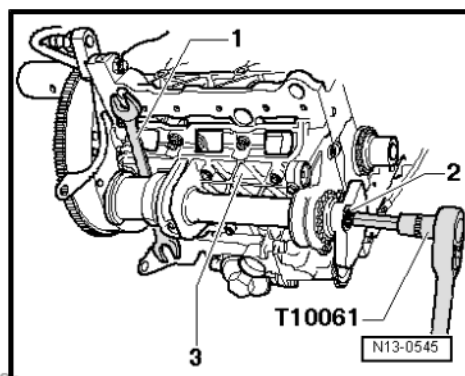
- ◆ *When positioning the mounting frame, check that the fixing guide is inserted in the engine block and that the seal ring is seated on the mounting frame.*
- ◆ *Align the mounting frame so that it is in the same level as the external edge of the engine block at the pulley edge.*
- Screw the mounting frame with the balance shaft to the engine block. Tightening torque: 20 Nm.
- Check that the mounting frame is aligned with the external edge of the engine block at the edge of the pulley.
- Immobilize the balance shaft as shown with a Wrench (24/27 mm AF) -1-.



Note

When immobilizing the balance shaft, check that the key is centered in the balance shaft and in a straight angle in relation to the balance shaft.

- Tighten the balance shaft fastening screw -2-. Tightening torque: 100 Nm + 90°.



Note

The fastening screw is a clamping screw and should always be replaced.

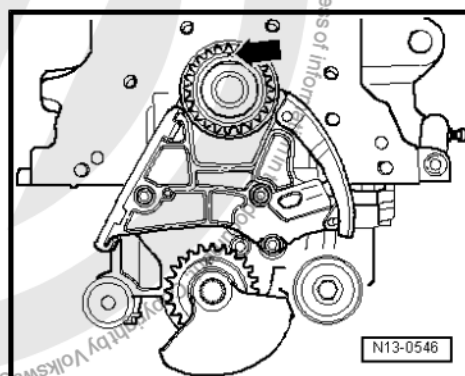
- Install the chain tensioner. Tightening torque: 8 Nm + 90°.



Note

The chain tensioner fastening screws are tensioner screws and always need to be replaced.

- Clean the chain with a lint-free cloth.
- Check that the mark in the crankshaft gear -arrow- is up.





- Position the chain on the crankshaft gear, oil pump gear and balance shaft gear. Check that the crankshaft gear and balance gear are aligned with the colour codes on the chain rings -arrows-.



Note

The colour coded chain rings are marked with a notch.

- Fit the free gear on the chain and tighten the free gear to the mounting frame. Tightening torque: 20 Nm.
- Remove the Pin - T10060- of the chain tensioner.
- Check that the crankshaft gear and balance shaft gear are aligned with the colour codes on the chain rings -arrows-.



Note

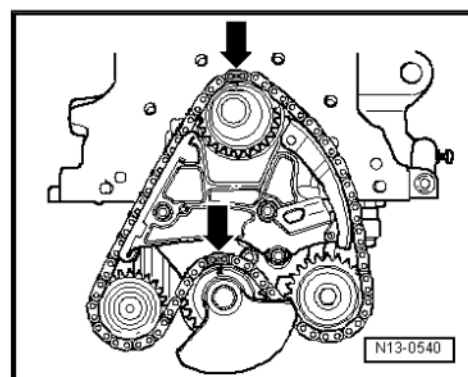
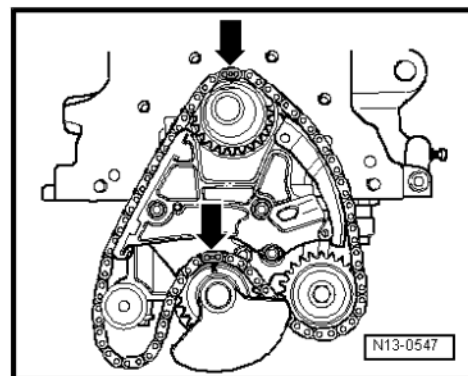
The colour coded chain rings are marked with a notch.

- Install the pulley edge seal flange ⇒ [page 18](#) .
- Install the balance shaft cover. Tightening torque: 5 Nm.



Note

- ◆ *Before installing the cover, lubricate the oil pump ring and the shaft on the inside of the cover.*
- ◆ *Check that the sealing strip is correctly fixed to the cover.*
- ◆ *When installing the cover, check the cover fitting in the mounting frame.*
- Install the oil pan ⇒ [page 71](#) .
- Install and adjust the toothed belt ⇒ [page 42](#) .
- Install Poly-V belt ⇒ [page 15](#) .





4 Crankshaft - remove and install



WARNING

Always replace self-locking nuts and bolts subject to angular torque



Note

- ◆ *Before removing the crankshaft, make sure that an appropriate surface was prepared to guarantee that the rotation sensor rotor is not damaged or that it does not touch another item.*
- ◆ *All bearing or sliding surfaces should be lubricated before assembly.*

1 - Shells 1, 2 and 4

- ☐ For the shell caps without oil groove.
- ☐ For engine block with oil groove.
- ☐ Do not exchange the bearing shells (mark).

2 - 65 Nm + 90°

- ☐ Renew after each removal.
- ☐ To measure radial clearance with 65 Nm, do not exceed.

3 - Bearing cap

- ☐ Bearing cap 1: Pulley side.
- ☐ Shell retaining tabs (block/bearing cap) should be on the same side.

4 - Bearing shell 3

- ☐ For bearing cap without oil groove.
- ☐ For engine block with oil groove.

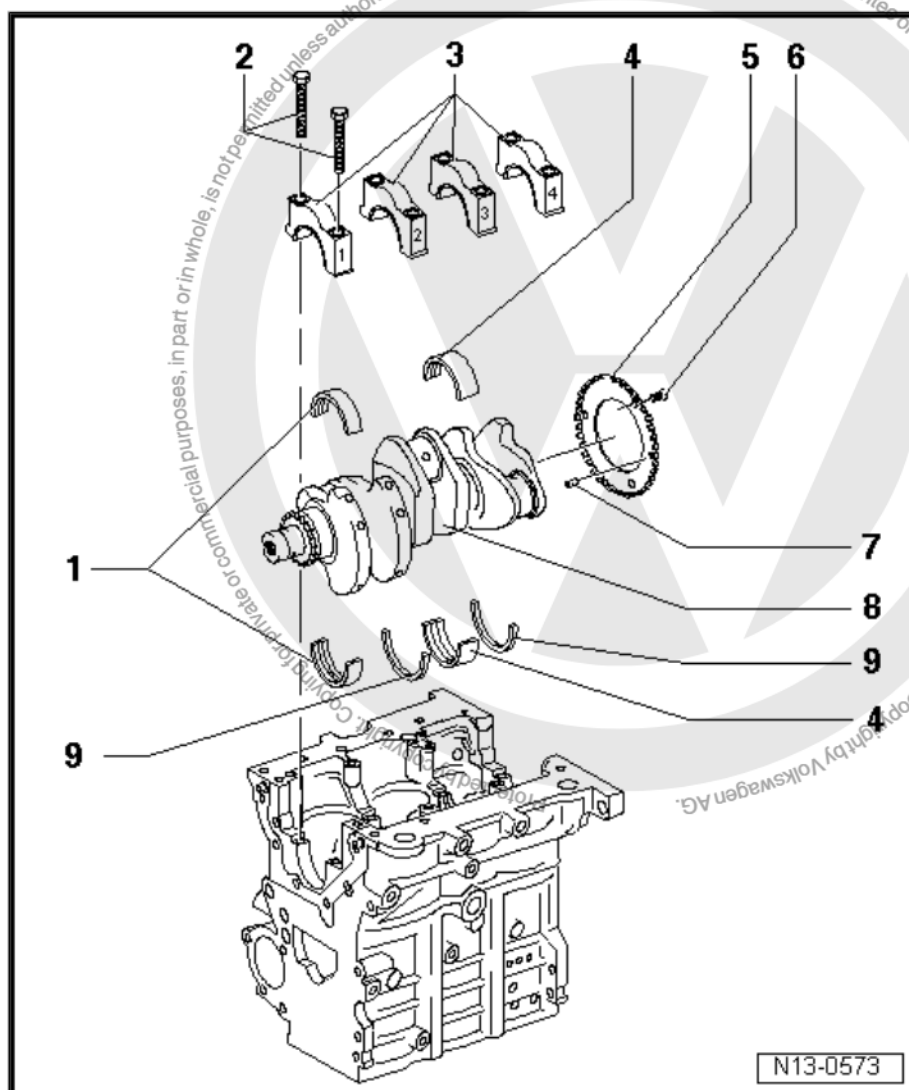
5 - Rotation sensor rotor

- ☐ To Engine speed sensor - G28- .
- ☐ Replace it if damaged.
- ☐ Replace the sensor rotor every time the screws are loosen.
- ☐ Remove and install.

⇒ [page 31](#)

6 - 10 Nm + 90°

- ☐ Renew after each removal.



N13-0573



7 - Adjusted pin

- ☐ Check the projection from the crankshaft ➤ [page 31](#)

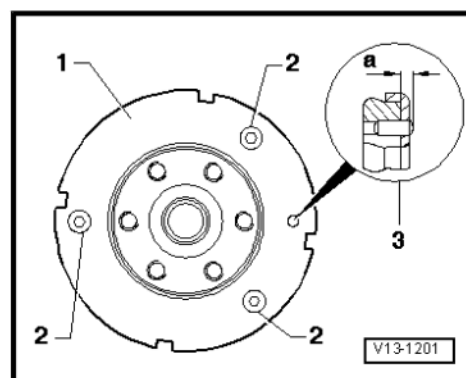
8 - Crankshaft

- ☐ See notes before removing ➤ [page 30](#).
- ☐ New axial clearance: 0,07...0,17 mm. Wear limit: 0.37 mm.
- ☐ Measure radial clearance using Plastigage. New: 0.03...0.08 mm. Wear limit: 0.17 mm.
- ☐ Do not rotate crankshaft while checking radial clearance.
- ☐ Crankshaft dimensions ➤ [page 31](#).

9 - Thrust ring

- ☐ For cylinder block, bearing 3.

Check projection of adjusted pin to the outside of the crankshaft



Special tools and workshop equipment required

- ◆ Depth pachymeter

Test sequence

- Use a Depth pachymeter to check the projection -a- of the adjusted pin, with the rotation sensor pulley -1- removed.

- 1 - Rotation sensor rotor.
- 2 - Fastening screw.
- 3 - Projection of the adjusted pin -3- to the outside of the crankshaft a = 2,5...3,0 mm.

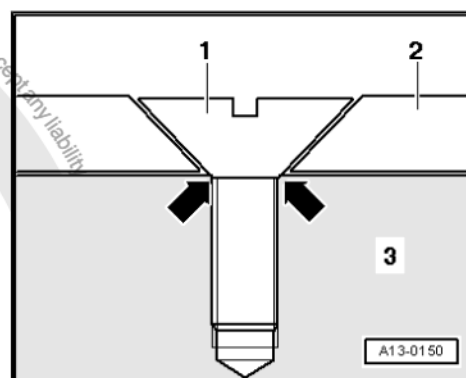
Removal and installation of the rotation sensor rotor

- Replace the rotational speed sender -2- every time the screws -1- are loosened. Tightening torque: 10 Nm + 90°.



Note

The second time the screws are tightened, the contact point, in the rotation sensor rotor, is deformed enough to allow the screw head to support itself -arrows- on the crankshaft -3-, enabling the rotation sensor pulley to remain loose under the screws.



4.1 Crankshaft dimensions

(in mm)



Finishing dimension	Crankshaft bearing trunnion -Ø	conrod bearing crankpin-Ø
Basic dimension	-0.022 54.00 -0.042	-0.022 47.80 -0.042
First grinding	-0.022 53.75 -0.042	-0.022 47.55 -0.042
Second grinding	-0.022 53.50 -0.042	-0.022 47.30 -0.042
Third grinding	-0.022 53.25 -0.042	-0.022 47.05 -0.042



5 Pistons and bearing rods - disassemble and assemble



WARNING

Always replace self-locking nuts and bolts subject to angular torque



Note

All bearing or sliding surfaces should be lubricated before assembly.

1 - Piston ring

- ☐ Move openings 120°.
- ☐ Remove and install with piston ring pliers.
- ☐ The "TOP" mark must point towards the piston head.
- ☐ Check the opening between the ring edges
⇒ [page 34](#)
- ☐ Check ring clearance in the piston groove
⇒ [page 35](#)

2 - Piston

- ☐ With combustion chamber.
- ☐ Mark installation position and the correspondence to the respective cylinder ⇒ [page 36](#)
- ☐ The piston crown arrow should indicate the direction of the pulley.
- ☐ Install using a piston ring compressor.
- ☐ Replace the piston in case there are cracks in its skirt.
- ☐ Check the PMS piston projection ⇒ [page 36](#).

3 - Piston pin

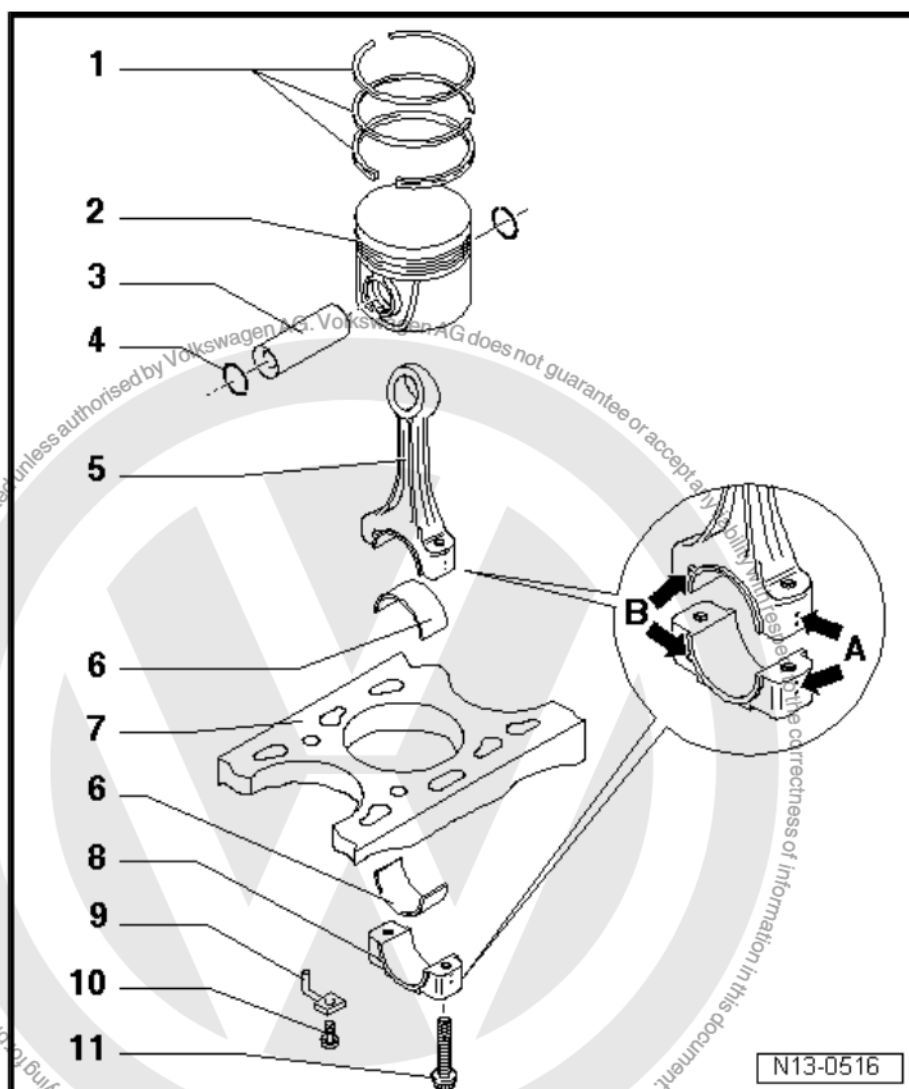
- ☐ In case of difficulties during removal, heat piston to 60°C.
- ☐ Remove and install with Puller and Fitter - VW 222A-.

4 - Piston pin retaining ring

- ☐ Renew.

5 - Connecting rod

- ☐ Replace set only.





- ☐ Mark corresponding position relative to cylinder -A-.
- ☐ Installation position: Marks-B- point towards the pulley side.

6 - Bearing shell

- ☐ Check installation position.
- ☐ Observe the version: Upper shell (closer to the piston) is made of a material which is more resistant to wear. Identification: Black line on the shell surface in the union area.
- ☐ Do not mix used bearing shells.
- ☐ Install the center bearing shells.
- ☐ Distance from the edge of the bearing shell to the external shell of the bearing rod/cap: 2.5 mm, one side measurement.
- ☐ Check that it is firmly seated.
- ☐ Axial clearance. Wear limit: 0.37 mm.
- ☐ Check radial clearance using Plastigage: Wear limit: 0.08 mm. Do not rotate crankshaft while checking radial clearance.

7 - Cylinder block

- ☐ Check cylinder diameters ⇒ [page 35](#)
- ☐ Piston and cylinder dimensions ⇒ [page 37](#) .

8 - Connecting rod cap

- ☐ Check installation position.

9 - Oil ejector

- ☐ For piston cooling.
- ☐ Note assembly position: Install by turning the oil ejector in the counterclockwise to the stop.

10 - 25 Nm

- ☐ Insert a sealant.

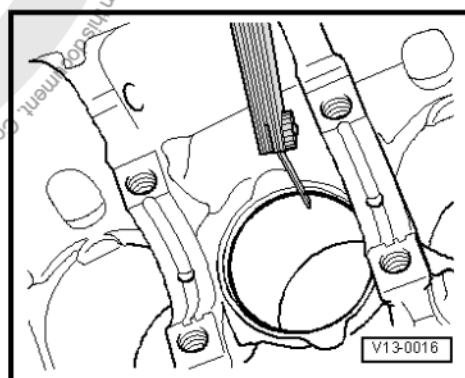
11 - Connecting rod screw, 30 Nm + 90°

- ☐ Renew after each removal.
- ☐ Lubricate the thread and contact surface.
- ☐ First uniformly tighten with 5 Nm.
- ☐ To measure the radial clearance, use old screws.

Check the opening between the piston ring edges

- Firmly introduce the upper ring to approximately 15 mm of the cylinder lower edge.

Piston ring Dimensions in mm	New	Wear limit
1- Compression ring	0.25...0.40	1.0
2- Compression ring	0.20...0.40	1.0
Oil scraper ring	0.25...0.50	1.0

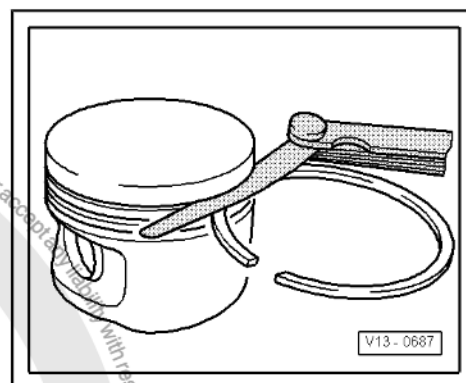




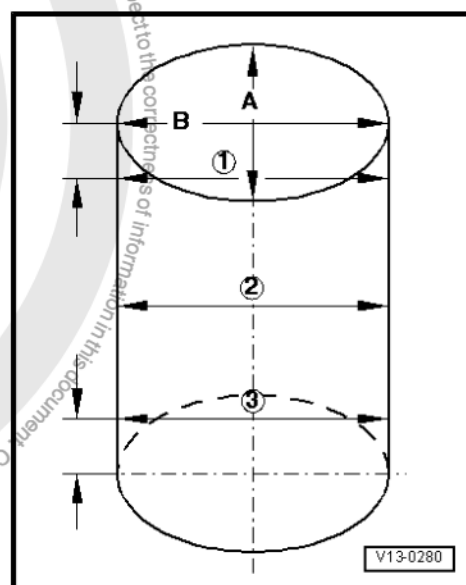
Check ring clearance in the piston groove

Clean the groove before checking.

Piston ring Dimensions in mm	New	Wear limit
1- Compression ring	0.06...0.09	0.25
2- Compression ring	0.05...0.08	0.25
Oil scraper ring	0.03...0.06	0.15



Check cylinder diameters



Special tools and workshop equipment required

- ◆ Precision internal micrometer 50...100 mm
- Measure at three different points, in cross pattern, in transversal -A- and longitudinal -B- directions, with a distance of 10.0 mm from upper and lower edges as illustrated. Nominal size deviation, maximum 0.10 mm.



Note

The cylinder diameter cannot be measured while the engine block is secured to the assembly stand with the Rotating engine and transmission stand - VAS 6095- , because that can lead to incorrect measures.

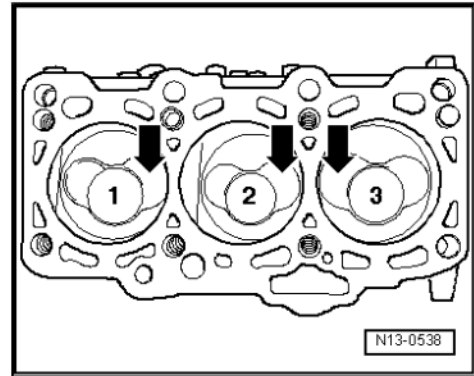
Installation position and the correspondence to the respective cylinder

Piston for cylinders 1 and 2.

Bigger intake valve chamber in the direction of the flywheel
-arrows-.

Piston for cylinder 3.

Bigger intake valve chamber in the direction of the pulley
-arrow-.



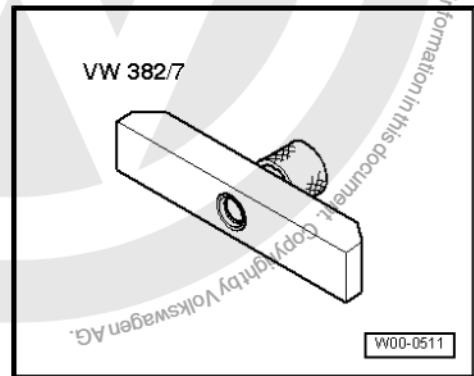
Note

- ◆ *The new correspondence between pistons and cylinders is indicated by colored marking on the piston head.*
- ◆ *Piston for cylinders 1 and 2: marking 1/2.*
- ◆ *Piston for cylinder 3: marking 3.*

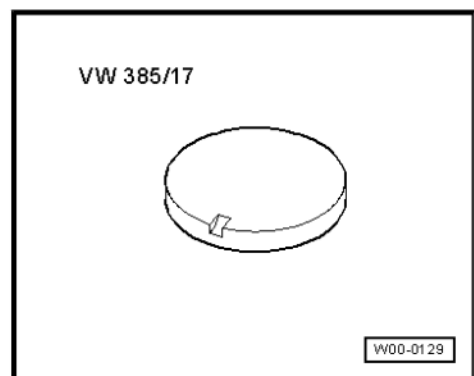
Check piston protrusion at TDC

Special tools and workshop equipment required

- ◆ Measuring bridge - VW 382/7-



- ◆ Universal measuring tool - VW 385/17-





Test sequence

- The PMS piston projection should be measured when installing new pistons. Depending on the piston projection, install the corresponding cylinder head gasket according to the following table:



Note

Turn the engine clockwise to check the piston projection in the PMS.

Piston projection	Identification Holes/grooves
0.91 mm ... 1.00 mm	1
1.01 mm ... 1.10 mm	2
1.11 mm ... 1.20 mm	3

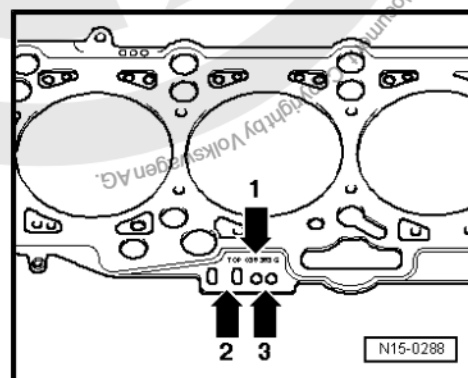
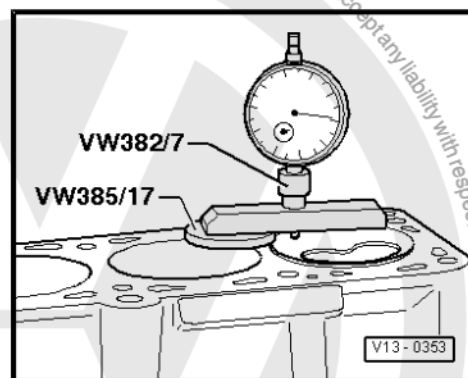
Identification of cylinder head gasket

- ◆ Part No. = -arrow 1-.
- ◆ Production control code = -arrow 2- (can be disregarded).
- ◆ Holes = -arrow 3-.



Note

If different values are obtained when measuring the piston projection, consider the higher value when selecting the cylinder head gasket.



5.1 Piston and cylinder dimensions

Finishing dimension		Piston Ø	Cylinder Ø
Basic dimension	mm	79.47	79.51
Grinding 1	mm	79.97	80.01



15 – Cylinder head, valve gear

1 Cylinder head - remove and install

Check compression ⇒ [page 49](#) .



WARNING

Always replace self-locking nuts and bolts subject to angular torque



Note

- ◆ *When installing a spare cylinder head with camshaft installed, it is necessary to lubricate contact surfaces between tappet and cams, before installing the cylinder head cover.*
- ◆ *All bearing or sliding surfaces should be lubricated before assembly.*
- ◆ *The plastic shims provided for protecting the open valves should not be removed until immediately before fitting the cylinder head.*
- ◆ *When replacing the cylinder head, all coolant must also be replaced.*





1 - Upper cover to mechanical distributor

2 - Toothed belt

- ☐ Before removing, mark the direction of operation.
- ☐ Check for wear.
- ☐ Do not bend.
- ☐ Removal, installation and adjustment
⇒ [page 42](#).

3 - 10 Nm

4 - 25 Nm

5 - 100 Nm

6 - Camshaft gear

7 - Pulley

- ☐ With engine phase sensor pulley.
- ☐ Use the Counterhold tool - T10051- to loosen or tighten.
- ☐ For such, use the Extractor - T10052-.
- ☐ Remove and install
⇒ [page 59](#).

8 - Mechanical distribution rear cover

9 - Seal

- ☐ Replace it if damaged.

10 - Hall Sender - G40-

- ☐ To the camshaft position.
- ☐ To remove, remove the seal ring ⇒ [Item 9 \(page 39\)](#).

11 - Cylinder head fastening screw

- ☐ Renew.
- ☐ Observe the sequence when loosening or tightening ⇒ [page 46](#).
- ☐ Before installing, adjust the washers on the cylinder head ⇒ [Item 4 \(page 52\)](#).

12 - Pin, 10 Nm

- ☐ For engine cover

13 - Cylinder head cover

- ☐ With oil filling nozzle.
- ☐ Replace the oil filling nozzle if the cylinder head lid is damaged.
- ☐ Before assembly, completely clean the cylinder head lid sealing surface with a clean cloth.

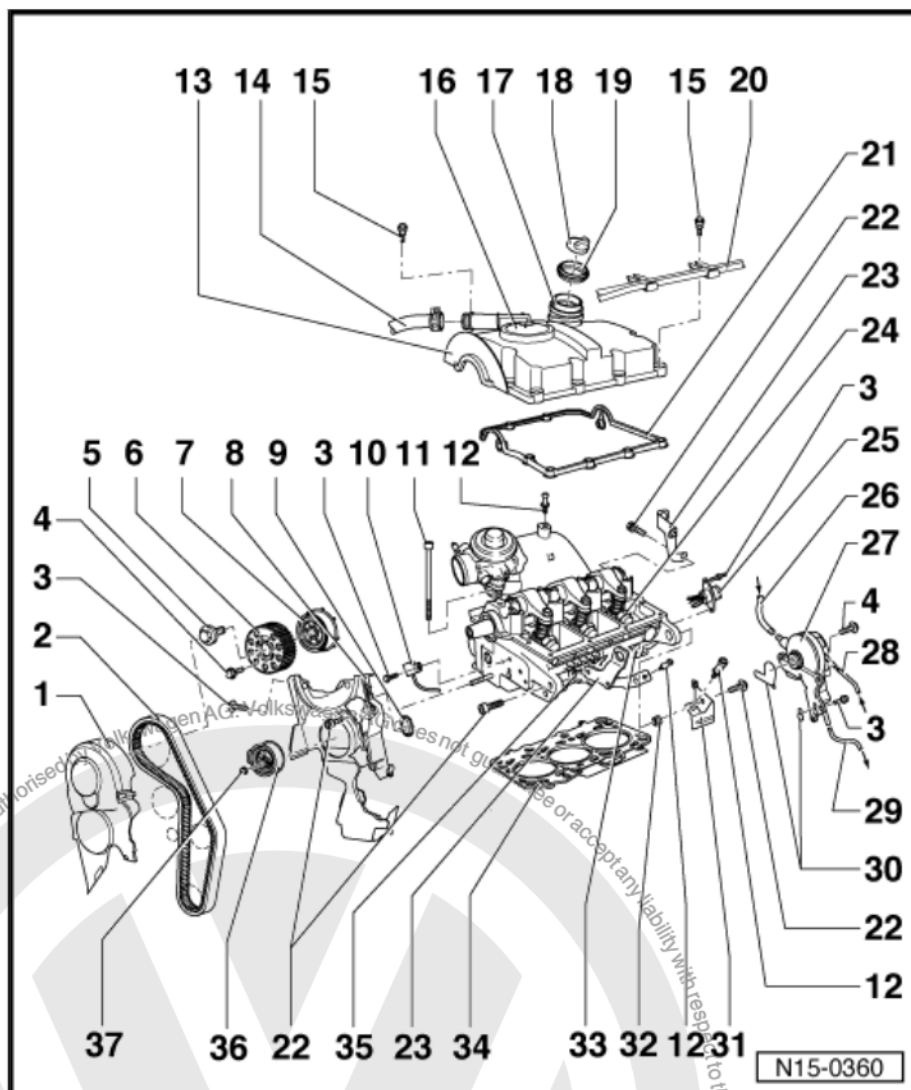
14 - For the turbocharger

15 - 10 Nm

- ☐ First, manually tighten all screws.
- ☐ After that, tighten the upper and the rest of the screws from the inside to the outside, diagonally, according to the specified torque.

16 - Pressure regulating valve

- ☐ For the crankcase vent.





- 17 - Oil filling nozzle
 - ☐ Renew.
- 18 - Cap
 - ☐ Replace the seal, if damaged.
- 19 - Gasket
 - ☐ Replace it if damaged.
- 20 - Mounting bracket
 - ☐ With fuel line/hose.
- 21 - Cylinder head cover gasket
 - ☐ Replace it if damaged.
- 22 - 20 Nm
- 23 - Suspension eyelet
- 24 - Injector unit
 - ☐ Remove and install ⇒ [page 115](#) .
- 25 - Central connector
 - ☐ For the injector.
- 26 - For brake servo
- 27 - Tandem Pump
 - ☐ To supply fuel and vacuum.
 - ☐ Remove and install ⇒ [page 101](#) .
 - ☐ Check ⇒ [page 99](#) .
- 28 - Supply hose
 - ☐ From the fuel filter ⇒ [Item 1 \(page 91\)](#) .
 - ☐ White or white-marked.
 - ☐ Check that it is firmly installed.
 - ☐ Fasten with spring braces.
- 29 - Return hose
 - ☐ To the fuel filter ⇒ [Item 1 \(page 91\)](#) .
 - ☐ Blue or blue-marked.
 - ☐ Check that it is firmly installed.
 - ☐ Fasten with spring braces.
- 30 - Gasket
 - ☐ Renew.
- 31 - Mounting bracket
- 32 - Hex nut
- 33 - Cylinder head
 - ☐ Remove and install ⇒ [page 46](#) .
 - ☐ When replacing, replace all coolant.
- 34 - Cylinder head gasket
 - ☐ Renew.
 - ☐ Check the mark ⇒ [page 41](#)
 - ☐ When replacing, replace all coolant.
- 35 - Glowplug
 - ☐ 15 Nm.





36 - Tensioner

37 - 20 Nm + 45°

- ☐ Renew after each removal.

Check for warping on the cylinder head



Note

- ◆ Max. permissible bending: 0.1 mm.
- ◆ Reworking of cylinder heads in diesel engines is not allowed.

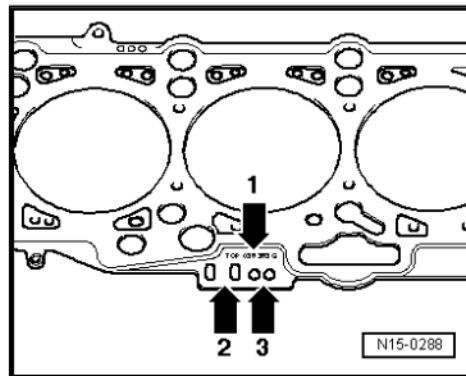
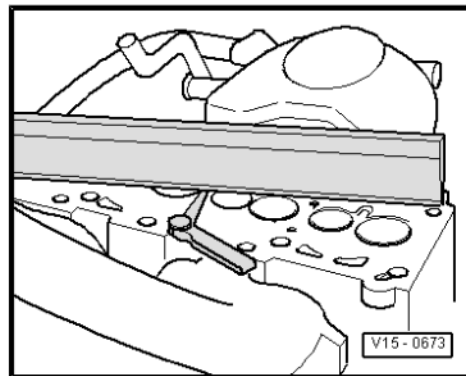
Identification of cylinder head gasket

- ◆ Part No. = -arrow 1-.
- ◆ Production control code = -arrow 2- (can be disregarded).
- ◆ Holes = -arrow 3-.



Note

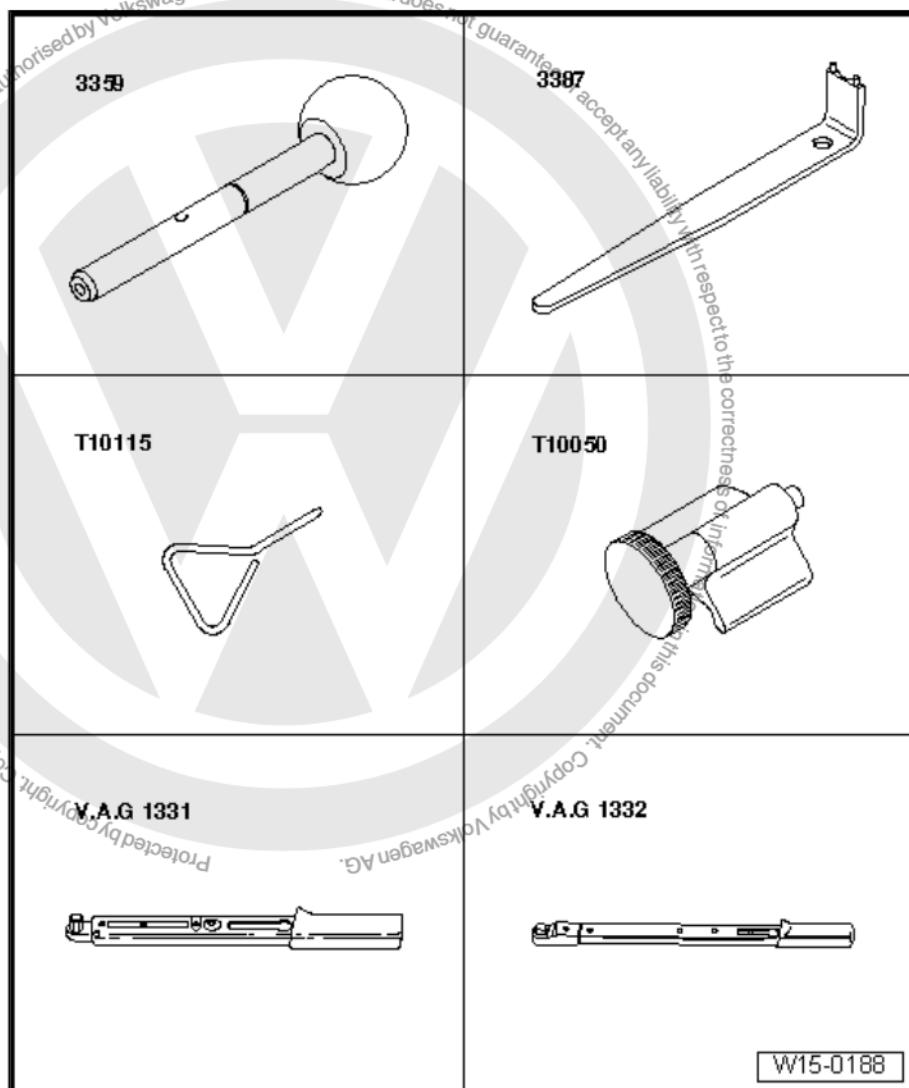
Different cylinder head gaskets are assembled according to the piston projection. When replacing the cylinder head gasket, install a new gasket with the same identification.





1.1 Toothed belt - remove and install, adjust

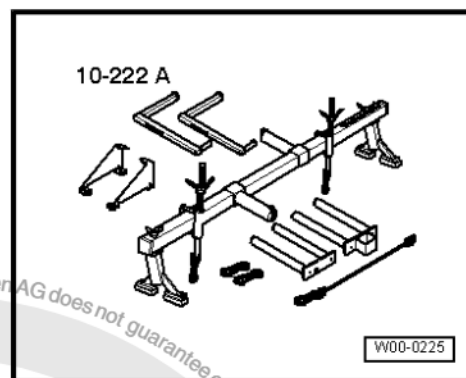
Special tools and workshop
equipment required



- ◆ Diesel injection pump lock pin - 3359-
- ◆ Pin wrench - 3387-
- ◆ Locking pin - T10015-
- ◆ Crankshaft locking tool - T10050-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Torque Wrench - 40 to 200 Nm (1/2" drive) - VAG 1332-



- ◆ Support device - 10-222A- with feet - 10-222 A/1-



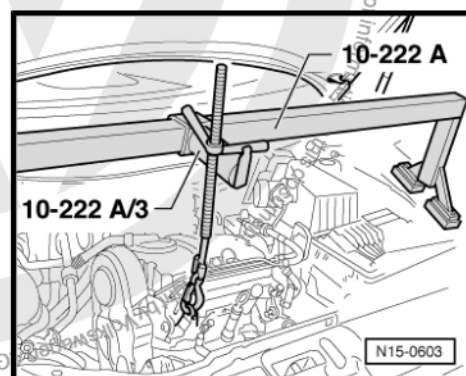
1.1.1 Removal



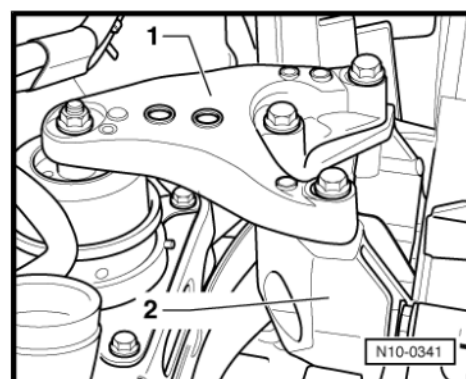
Note

The adjustment work on toothed belts can only be made in cold engines because the tensioner element indicator changes according to the engine temperature.

- Remove the engine cover panel.
- Remove the hose between the intercooler and the intake flange.
- Install the Support device - 10-222A- as shown and support the engine in its installation position.



- Remove the engine support -1- and the engine console -2-.
- Remove the Poly-V belt ⇒ [page 15](#) .
- Remove the Pin - T10060- from the tensioner.
- Remove the mechanical distribution top cover.
- Remove the noise insulation from the engine ⇒ Rep. gr. 50 .
- Remove the hose between the intercooler and the turbocharger.
- Cover or seal the open tips carefully.
- Remove the vibration damper.
- Remove mechanical distributor central cover.
- Remove lower cover to mechanical distributor.
- Turn the crankshaft until the cylinder 1 PMS.





Note

Turn the crankshaft until the crankshaft pulley mark is turned upwards and the upper part of the toothed belt is aligned with the phase sensor pulley hub projection -arrows-.

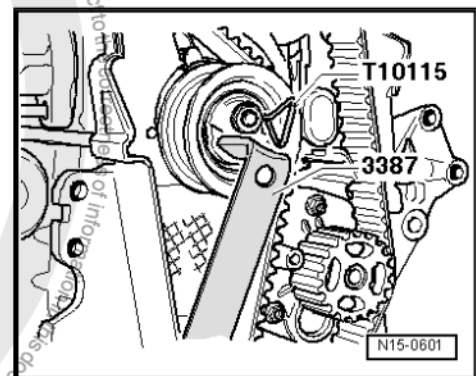
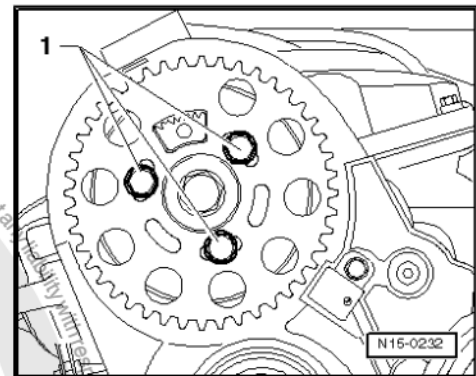
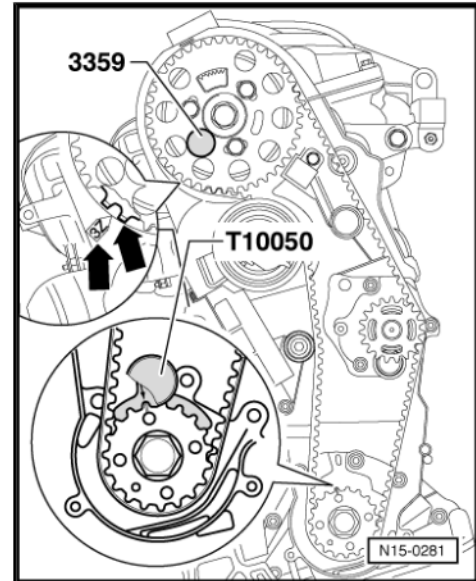
- Immobilize the hub with the Mandrel - 3359- . For such, slide the mandrel through the free elongated hole on the left side and inside the cylinder head hole.
- Fix the toothed belt gear which is in the crankshaft using the crankshaft limiter - T10050- . For such, push the crankshaft limiter from the gear to the gear teeth.



Note

The gear mark on the crankshaft and on the crankshaft limiter must be aligned. At the same time, the crankshaft limiter should fit in the seal flange.

- Mark the operation direction of the toothed belt.
- Release the fastening nut from the tensor.
- Release the valve crankshaft gear fastening screws -1-, until the crankshaft can be moved inside the elongated holes.



- Turn the Pin wrench - 3387- counterclockwise (opposite direction of the arrow) until the toothed belt tensioner can be fixed with the Lock pin - T10115- .
- Turn the Pin wrench - 3387- clockwise in the direction of the -arrow- until the stop and remove the toothed belt from the water pump first and then from the other gears.

1.1.2 Installation

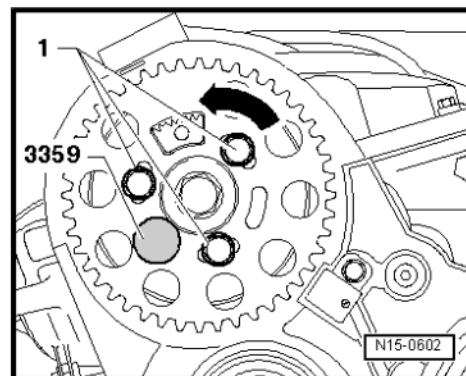


Note

The adjustment work on toothed belts can only be made in cold engines because the tensioner indicator changes according to the engine temperature.



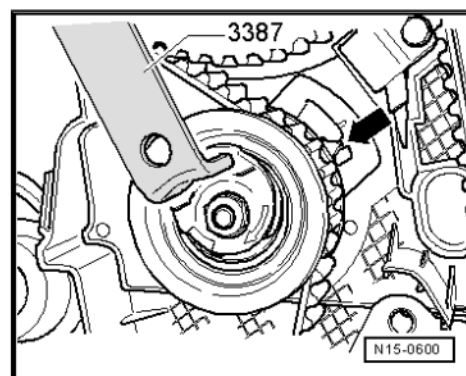
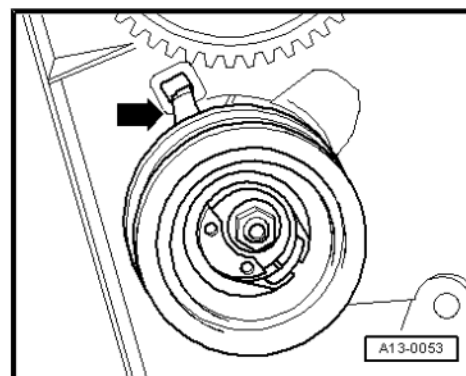
- Turn the elongated holes valves crankshaft gear counterclockwise - in the direction of the arrow- against the limiter.
- Install the toothed belt in the gear of the camshaft, in the tensioner and in the gear of the crankshaft.



Note

Check the correct seating of the tensioner on the rear cover mechanical distribution -arrow-.

- Turn the tensioner using the Pin wrench - 3387- in the direction of the -arrow- against the limiter and install toothed belt on the water pump.
- Relieve the tension of the tensioner turning it with the Pin wrench - 3387- on the opposite direction of the arrow.
- Carefully turn the tensioner using the Pin wrench - 3387- in the direction of the arrow until the indicator is in the middle of the slit on the base plate -arrow-.
- Hold the tensor on this position and tighten the fastening nut with: 20 Nm + 45°.
- Tighten camshaft gear securing bolt with 25 Nm.
- Remove the Mandrel - 3359- and Crankshaft limiter - T10050-
- Turn crankshaft twice in the engine rotation direction until it is again in cylinder 1 TDC.

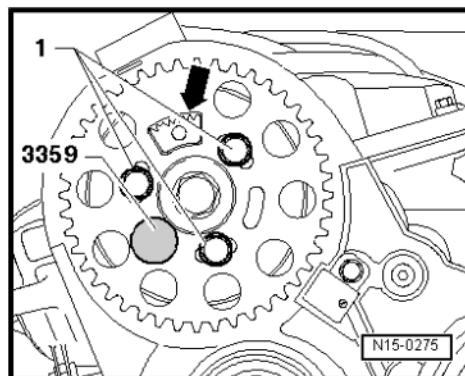


Note

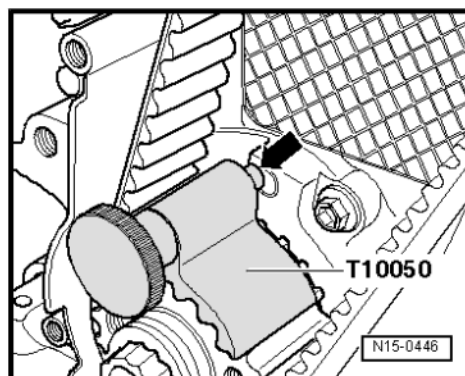
- ◆ The crankshaft limiter tip should fit in the seal flange when turning the engine.
 - ◆ If the crankshaft is turned beyond the TDC of cylinder 1 and the crankshaft locking tool did not engage in the sealing flange, turn the crankshaft 1/4 turn back so that the TDC for Cylinder 1 may be adjusted again. It is not permissible to make corrections while the crankshaft is turned to ensure correct engagement of the crankshaft locking tool.
 - Once the Crankshaft limiter - T10050- has been activated, check that the gear can be locked using the Lock pin - 3359-.
- If the hub cannot be locked:
- Pull the crankshaft limiter - T10050- of the seal flange hole and turn the crankshaft until the gear can be locked with the Lock pin - 3359-.



- Loosen camshaft gear fastening screw. -1-.



- Turn the crankshaft slightly contrary to the engine rotation until the Crankshaft limiter - T10050- is positioned in front of a seal flange hole -arrow-
- Turn the crankshaft in the direction of the engine rotation until the crankshaft limiter locks on the seal flange during the turn.
- Tighten camshaft gear securing bolt with 25 Nm.
- Remove the mandrel -3359- and Crankshaft limiter - T10050- .
- Turn crankshaft twice in the direction the engine turns until it is in the TDC of cylinder 1 again.



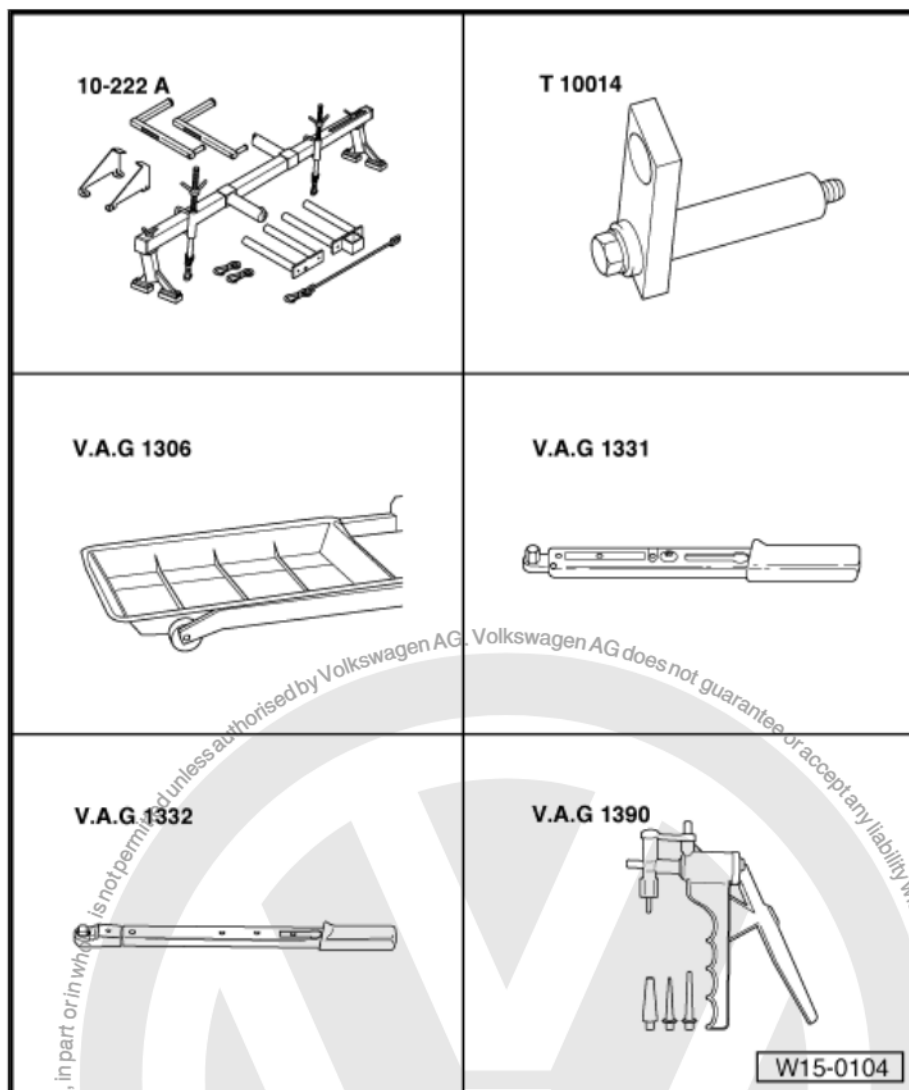
Note

- ◆ The crankshaft limiter tip should fit in the seal flange when turning the engine.
- ◆ If the crankshaft is turned beyond the TDC of cylinder 1 and the crankshaft locking tool did not engage in the sealing flange, turn the crankshaft $\frac{1}{4}$ turn back in the opposite direction so that the TDC for Cylinder 1 may be adjusted again. It is not permissible to make corrections while the crankshaft is turned to ensure correct engagement of the crankshaft locking tool.
- Repeat the check.
- Install the lower mechanical distribution cover and the vibration damper.
- Install mechanical distributor central cover.
- Install the upper cover of the mechanical distribution.
- Install the engine support and console. Torques ⇒ [page 8](#) .
- Install Poly-V belt ⇒ [page 15](#) .
- Install the hoses between the intercooler and the turbocharger and between the intercooler and the intake connection flange.
- Install the lower engine noise insulation ⇒ Body - External assembly works; Rep. gr. 50 ; Body - front part .

1.2 Cylinder head - remove and install



Special tools and workshop
equipment required



- ◆ Support bracket - 10-222A-
- ◆ Mounting bracket - T10014-
- ◆ Drip tray - VAG 1306-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Torque Wrench - 40 to 200 Nm (1/2" drive) - VAG 1332-
- ◆ Vacuum pump - V.A.G 1390-
- ◆ Fluid recipient - V.A.G 1390/1-





1.2.1 Removal

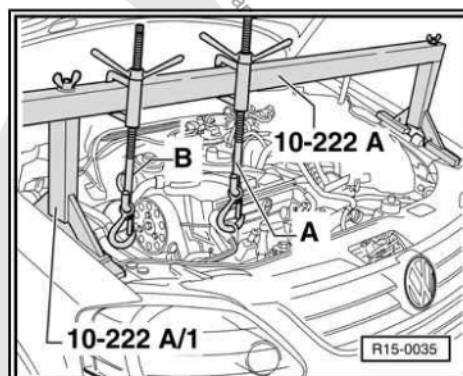
- Remove toothed belt ⇒ [page 42](#) .



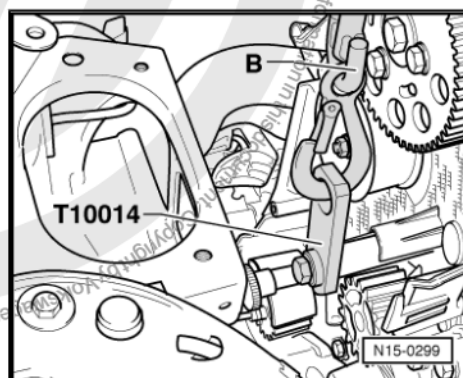
Note

Since the lifting eyelets are located on the cylinder head, to remove the cylinder head it will be necessary to fix an additional support to the engine block.

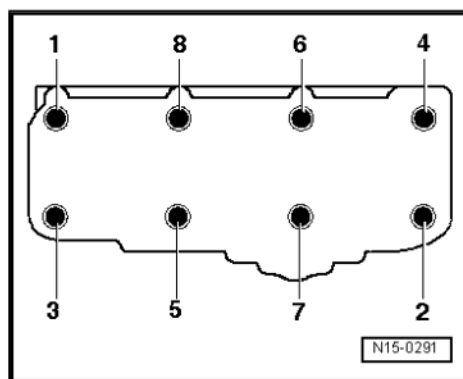
- Install the Support device - 10-222A- as shown and support the engine in its installation position.
- Fast and carefully lift the engine by the shaft -A-.



- Fix the Retainer - T10014- to the engine block by using a threaded hole close to the water pump, as shown. Tightening torque: 20 Nm.
- Quickly lift the engine using the second shaft -B- until shaft -A- is free.
- Remove the shaft -A-.
- Before removing the cylinder head, drain the fuel from the auxiliary pump using the manual vacuum pump - V.A.G 1390- with the bleeder container - V.A.G 1390/14 ⇒ [page 101](#) .



- Keep the indicated sequence when releasing or tightening the cylinder head screws.





1.2.2 Installation

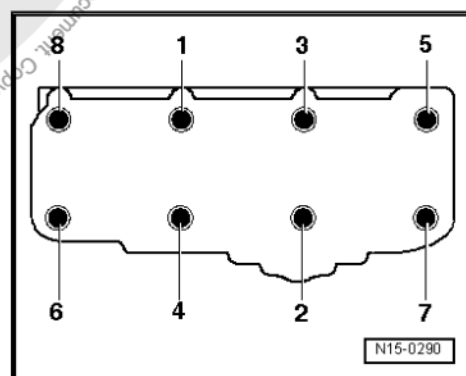
Note

- ◆ Always replace the cylinder head screws.
- ◆ In case of repair, carefully remove the gasket remains between cylinder head and engine block. Make sure there are no long scratches or grooves. When using sandpaper, the granulation can never be below 100.
- ◆ Carefully remove the excessive abrasive.
- ◆ Remove the new cylinder head casked from the package only right after installation.
- ◆ Handle the new gasket as carefully as possible. Damage to the silicone layer or to the serrated area will cause leakage.
- Turn the crankshaft to the PMS mark before installing the cylinder head.
- Turn the crankshaft opposite the engine rotation until all pistons are approximately positioned below PMS.
- Put cylinder head gasket.
- Assemble the cylinder head and manually tighten the screws.
- Tighten the cylinder head in four steps in the following sequence:
- 1. Previous tightening with torque wrench:

1st step (torque)	40 Nm
2nd step (torque)	60 Nm

- 2. Tightening with spanner:

3rd step (angular torque)	90°
4th step (angular torque)	90°



Note

After repair, it is not necessary to tighten the cylinder head again.

- After tightening the cylinder head, turn the camshaft so that the cylinder 1 cams are equally turned upwards. Before assembling the toothed belt, turn the crankshaft in the direction of the engine rotation until the PMS ➔ [page 42](#).
- Carry out a test drive and check the event memory ➔ [page 119](#).

1.3 Compression - check



Special tools and workshop
equipment required

3220 	V.A.G 1331
V.A.G 1381/12 	V.A.G 1763
<div>W15-0002</div>	

- ◆ U/J extension and socket, 10 mm - 3220-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Adapter - V.A.G 1381/12-
- ◆ Compression gauge - V.A.G 1763-

Test conditions

- Minimum engine oil temperature 30 °C.

Test sequence

- Remove the central connector from the unit injectors.
- Remove all glow plugs with U/J extension and socket 10 mm - 3220- .



- Install the Adapter - V.A.G 1381/12- in the glow plug sockets.
- Check compression with the compression meter - V.A.G 1763- .



Note

How to use the compression gauge ⇒ Instruction manual .

- Activate the starter until the gauge does not indicate even higher pressure.

Compression pressure:

New: 25...31 bar. Wear limit: 19 bar.

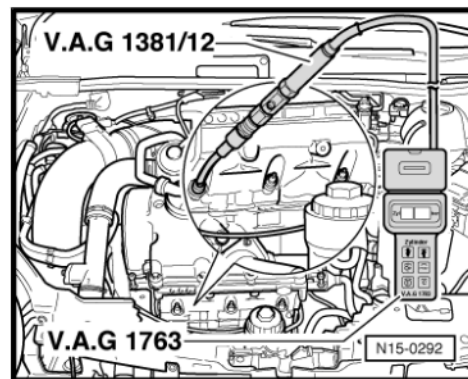
Acceptable difference between all cylinders: 5 bar.

- Assemble the glow plugs with U/J extension and socket 10 mm - 3220- . Tightening torque: 15 Nm.
- Check event memory, eliminate possible present failures and, then, erase event memory ⇒ [page 119](#).



Note

The removal of the injectors central connector from the drive causes the error log. Therefore, check the fault memory by deleting it, if necessary.





2 Valve command - repair



WARNING

Always replace self-locking nuts and bolts subject to angular torque



Note

- ◆ *Cylinder heads with cracks between the valve seats can still be used without reducing the useful life, provided that such cracks are small, maximum 0.5 mm wide.*
- ◆ *All bearing and sliding surfaces need to be lubricated before being installed.*

1 - 20 Nm + 90°

- ☐ Renew after each removal.
- ☐ Observe the sequence when loosening or tightening ⇒ [page 59](#).

2 - Injector drive arm shaft

3 - Cylinder head fastening screw

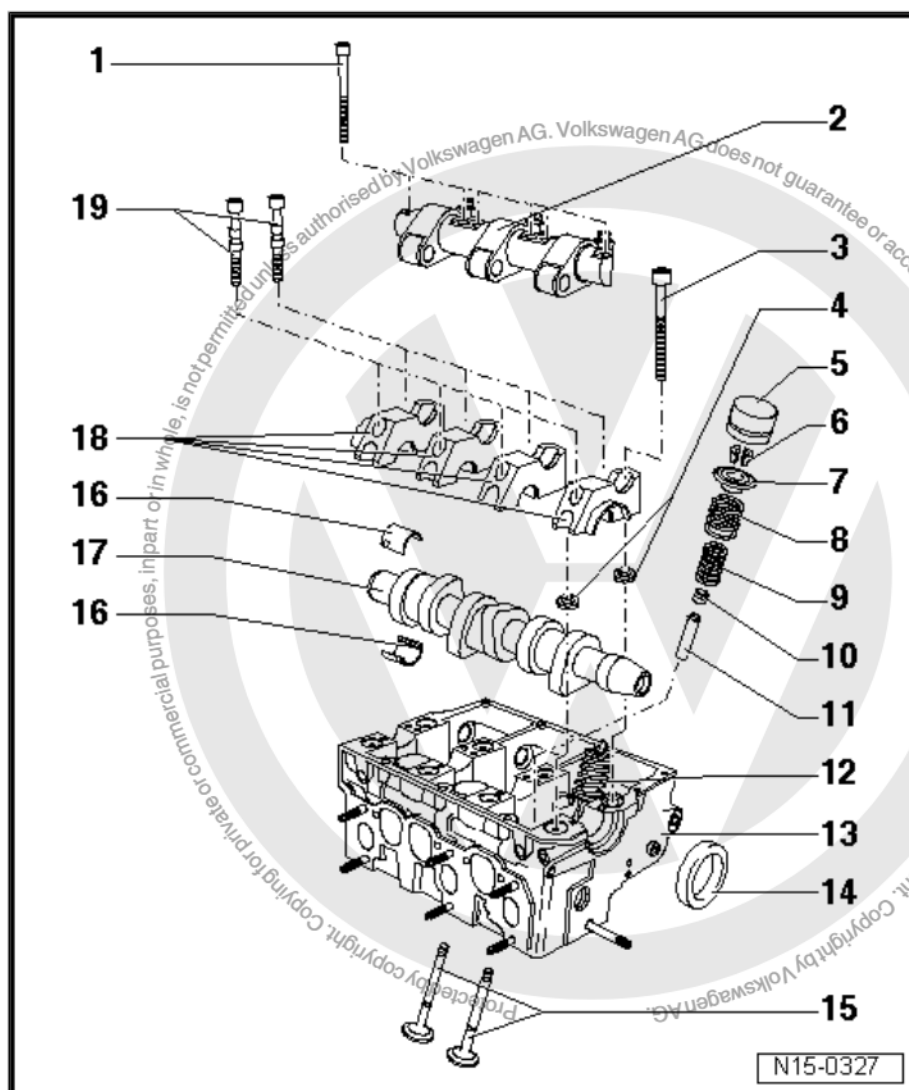
- ☐ Renew after each removal.
- ☐ Observe the sequence when loosening or tightening ⇒ [page 46](#).
- ☐ Before installing, put the washers ⇒ [Item 4 \(page 52\)](#).

4 - Washer

- ☐ For the cylinder head screws.

5 - Tappet

- ☐ Do not exchange.
- ☐ With valve clearance hydraulic offsetting.
- ☐ Store with the contact surface with cam turned downwards.
- ☐ Before installation, check the axial clearance of the camshaft ⇒ [page 54](#)
- ☐ Lubricate the contact surface.
- ☐ Before removing, remove the camshaft bearing covers.



N15-0327



6 - Keys

7 - Upper valve spring plate

8 - Valve spring

- ☐ Remove and install: Cylinder head removed: with the Compressor device - 2037- mounted
⇒ [page 57](#) .

9 - Internal valve spring

- ☐ Remove and install: Cylinder head removed: with the Compressor device - 2037- mounted
⇒ [page 57](#) .
- ☐ Install the cylinder head before putting the bearing covers.

10 - Valve stem sealant

- ☐ Replace ⇒ [page 57](#) .

11 - Valve guide

- ☐ Check ⇒ [page 57](#) .

12 - Injector unit

- ☐ Remove and install ⇒ [page 115](#) .

13 - Cylinder head

- ☐ Check the note ⇒ [page 52](#)
- ☐ Grind valve seats ⇒ [page 55](#)

14 - Oil seal

- ☐ Do not additionally lubricate or grease the seal lip.
- ☐ Before installation, remove oil residues from crankshaft journal with a clean cloth.
- ☐ To install, cover the groove in the conic part of the camshaft with adhesive tape.
- ☐ Remove and install.

15 - Valves

- ☐ Valve dimensions ⇒ [page 55](#)

16 - Bearing shell

- ☐ Do not exchange the bearing shells (mark).
- ☐ Make sure the correct seating of the clamps in the bearing and cylinder head covers.

17 - Camshaft

- ☐ Check axial clearance ⇒ [page 54](#)
- ☐ Remove and install ⇒ [page 59](#) .
- ☐ Measure radial clearance using Plastigage. Wear limit: 0.11 mm.
- ☐ Eccentricity max. 0.01 mm.
- ☐ Valve identification and timing ⇒ [page 55](#)

18 - Bearing cap

- ☐ Installation sequence ⇒ [page 59](#) .
- ☐ The bearing cover 4 is identified as bearing cover 5.
- ☐ When installing, use Sealant - AMV 17400401- to seal the bearing cover surfaces 1 and 4 which are in contact with the cylinder head ⇒ [page 54](#)

19 - 8 Nm + 90°

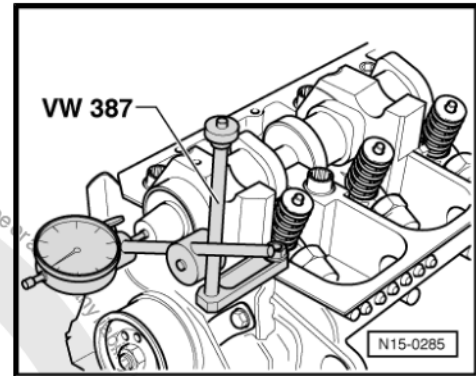
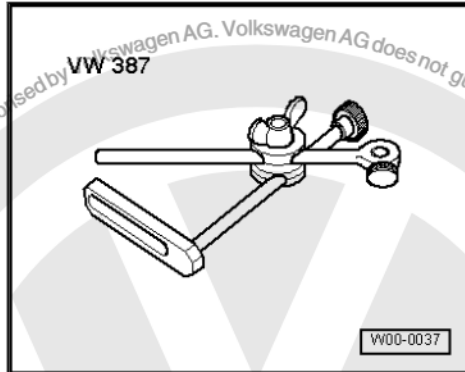
- ☐ Renew after each removal.



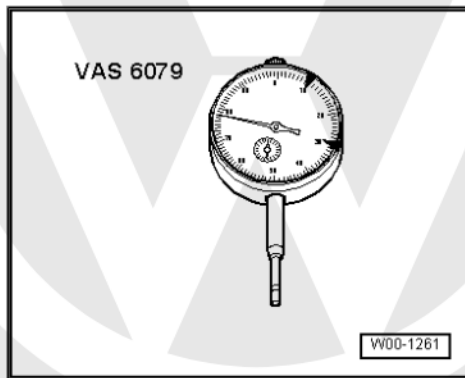
2.1 Camshaft - check axial clearance

Special tools and workshop equipment required

- ♦ Mounting bracket - VW 387-



- ♦ Dial gauge - VAS 6079-



Check crankshaft for axial clearance

Check with the removed tappets and with the installed bearing caps.

Wear limit: max. 0.15 mm.

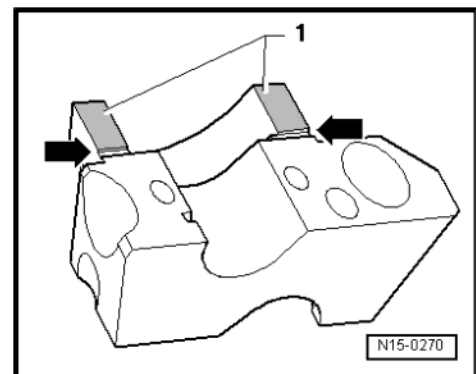
Seal the contact surfaces of the bearing caps 1 and 4 of the camshaft with Sealant - AMV 17400401-.

Apply the Sealant - AMV 17400401- on a thin and uniform layer on the surfaces -1-.



Note

- ♦ Make sure the sealant does not penetrate the grooves -arrows-.
- ♦ The bearing cover 4 is identified as bearing cover 5.





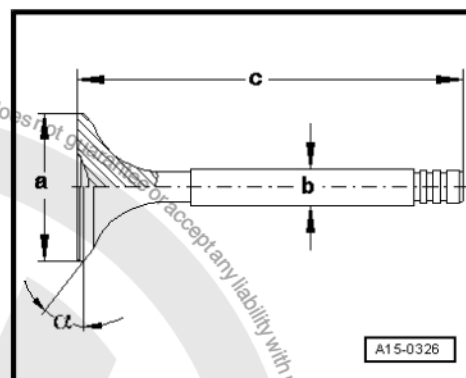
Valve dimensions



Note

Valves cannot be ground. Only sanding is permitted.

Size		Intake valve	Exhaust valve
$\varnothing a$	mm	35.95	31.45
$\varnothing b$	mm	6.980	6.956
c	mm	89.95	89.95
α	°	45	45



Valve identification and timing

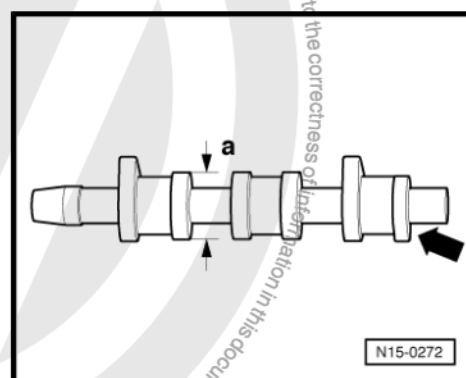
Identification

- ◆ Cam base circles -a- = $\varnothing 52.8$ mm.
- ◆ Identification through numbers and letters on the external surface of cylinder 3 exhaust valve cam:

Cylinder 3 -arrow-	1 R
--------------------	-----

Valve timing in the 1 mm valve opening

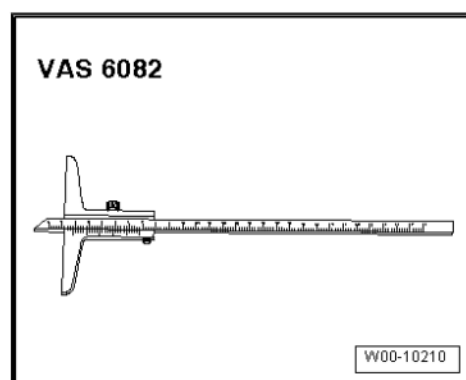
Intake opens after PMS	15.8°
Intake closes after PMI	25.3°
Exhaust opens before BDC	28.2°
Exhaust closes before TDC	18.7°



2.2 Valve seat - trim

Special tools and workshop equipment required

- ◆ Depth gauge - VAS 6082-



- ◆ Valve seat grinder



Note

- ◆ In case of repairs on engines with leaking valves, simply grinding or replacing the seats and valves is not enough. The valve guides must also be checked for wear, especially in engines with high mileage.
- ◆ Grind the valve seat only until a perfect fit is obtained. The maximum grinding size must be calculated before the work is done. When the grinding measurement is exceeded, the tappets hydraulic offsetting is no longer guaranteed, and the engine cylinder head must be replaced.

2.2.1 Calculate the maximum allowed grinding size

- Install valve and firmly press it against the seat.



Note

If the valve is replaced during repairs, use a new valve to measure.

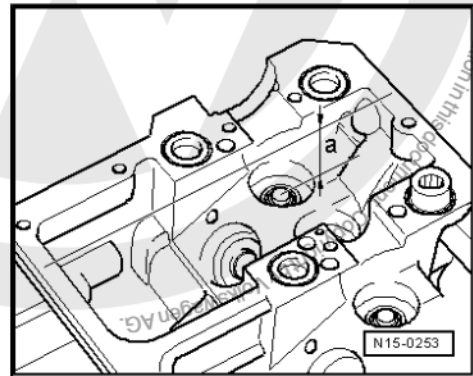
- Measure the distance -a- between the valve stem end and the upper edge of the engine cylinder head.
- Calculate the maximum grinding size admissible as from distance measured -a- and the minimum size.

Minimum size: 43.4 mm Intake valve and 43.2 mm exhaust valve.

Distance measured minus the minimum size = maximum allowed grinding size.

Example:

-	Measured distance	44.1 mm
	Minimum size	43.4 mm
=	Maximum allowed grinding size.	0.7 mm



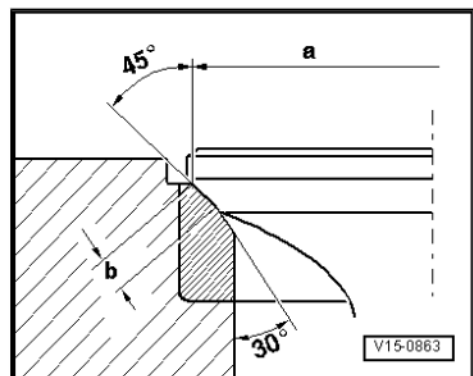
2.2.2 Intake valve seat - grind

- a = \varnothing 35.7 mm
- b = 1.6 mm
- 45° = Valve seat angle



Note

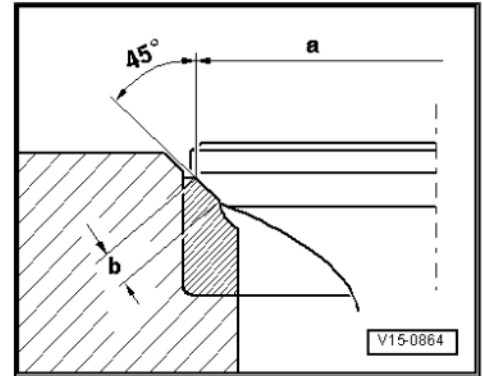
The 30° angle on the valve seating base is indispensable to guarantee the correct gas flow.





2.2.3 Exhaust valve seat - grind

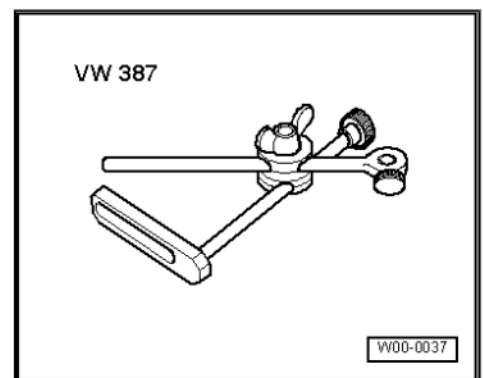
- a = \varnothing 31.4 mm
b = 2.7 mm
45° = Valve seat angle



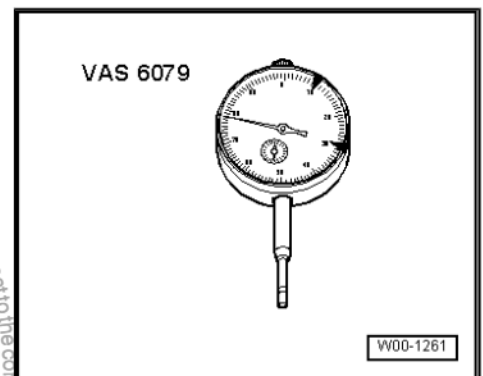
2.3 Valve guides - check

Special tools and workshop equipment required

- ◆ Mounting bracket - VW 387-



- ◆ Dial gauge - VAS 6079-



Test sequence

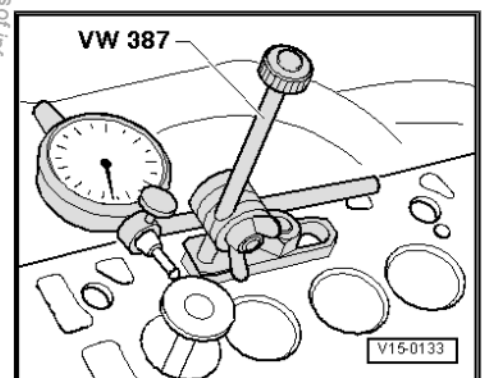
- Place a new valve on the guide. The end of the valve stem should be aligned with the guide. Due to different diameters of the stems, place the intake valves in the intake guides, and the exhaust valves in the exhaust guides.
- Measure tilting gap.

Tilt clearance. Wear limit: max. 1.3 mm.



Note

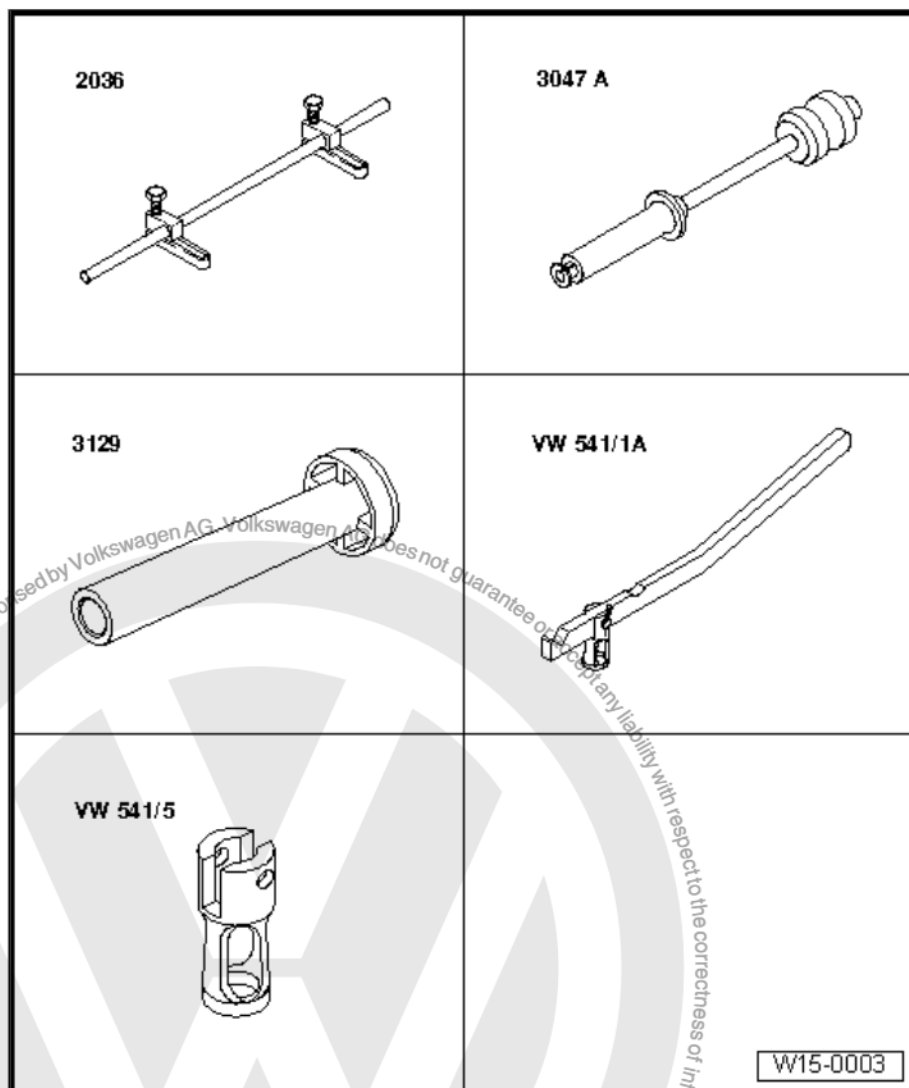
The cylinder head should be replaced if the clearance is bigger than the wear limit.



2.4 Valve stem seal - replace



Special tools and workshop
equipment required



- ◆ Device - 2036-
- ◆ Puller - 3047A-
- ◆ Locking pin - 3129-
- ◆ Lever - VW 541/1A-
- ◆ Compressor - VW 541/5-

2.4.1 Removal

(with the cylinder head installed).

- Remove camshaft ➔ [page 59](#) .
- Remove the tappets and place them with contact surface downwards. When doing so, make sure the tappets are not exchanged.
- Adjust the cylinder piston to the Top Dead Centre (TDC).



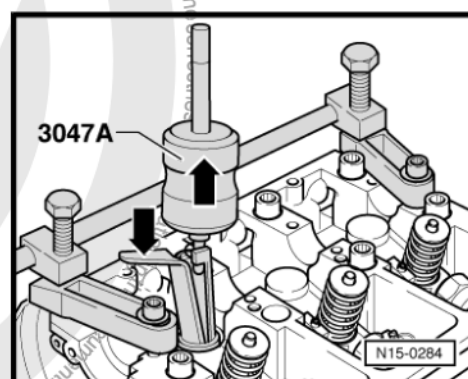
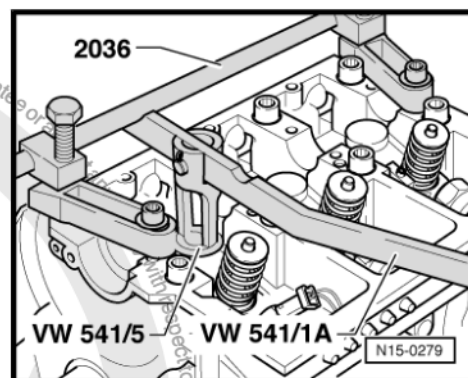
- Install the Device - 2036- and adjust to the plates height.
- Remove the valve springs with the Lever - VW 541/1A- and Compressor - VW 541/5- .



Note

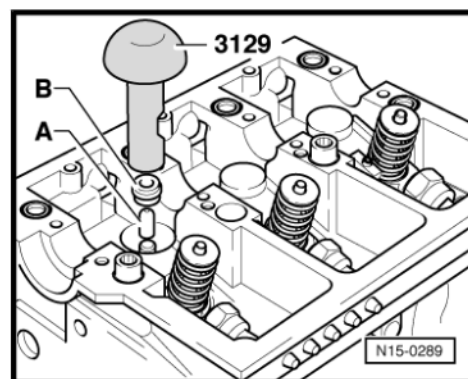
The valves will support the piston head.

- Remove the stem sealants with the Puller - 3047A- .



2.4.2 Installation

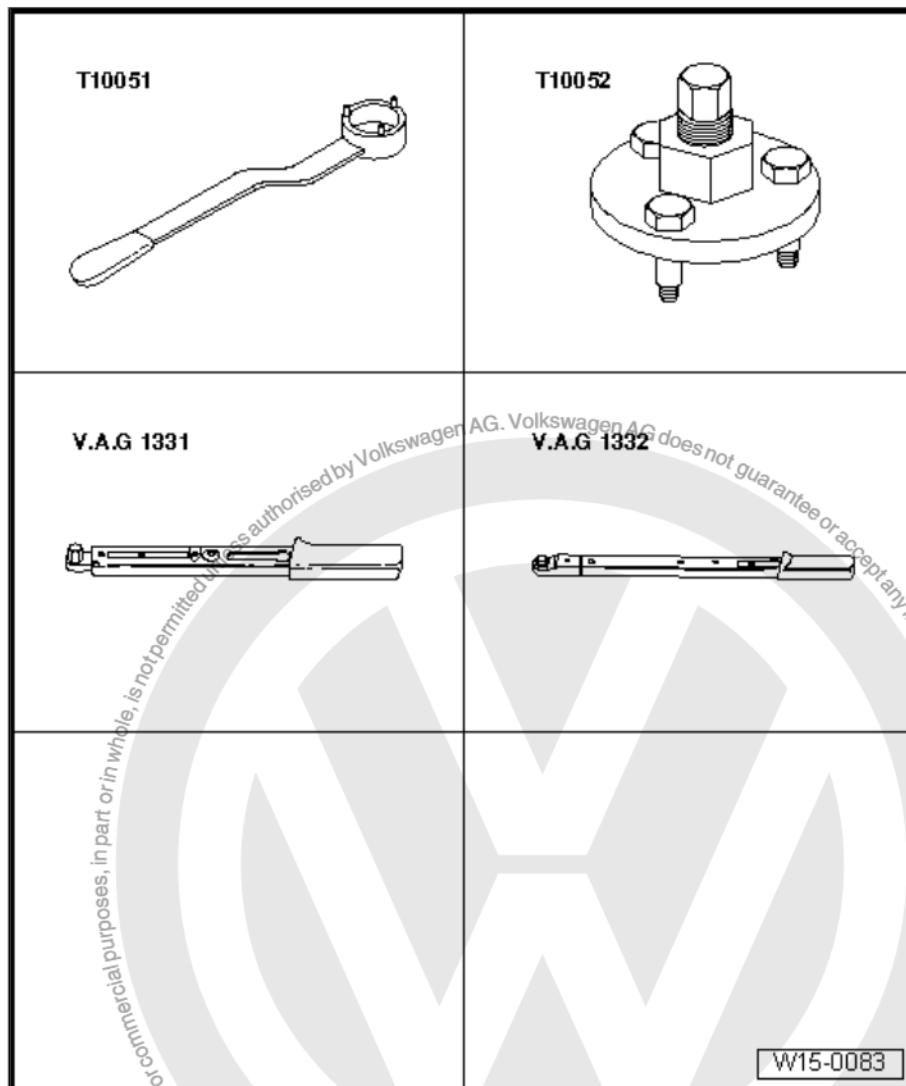
- Install the plastic sleeve -A- supplied in the respective valve stem. This will prevent the sealant from -B- being damaged.
- Insert the new valve sealant in the Fitter - 3129- .
- Lubricate the sealant lip of the stem valve seal and carefully tighten it on the valve guide.



2.5 Camshaft - remove and install



Special tools and workshop
equipment required



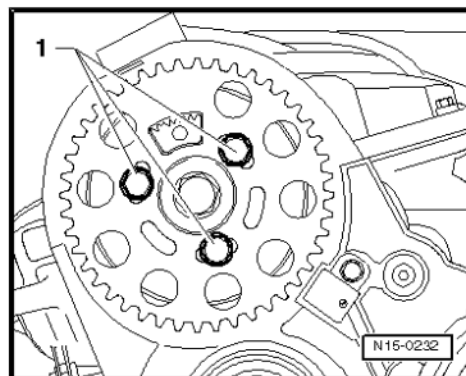
- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Torque Wrench - 40 to 200 Nm (1/2" drive) - VAG 1332-
- ◆ Sealing putty - AMV 17400401-

2.5.1 Removal

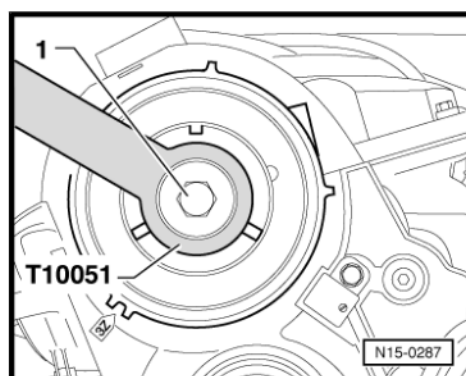
- Remove the Poly-V belt ⇒ [page 15](#) .
- Remove toothed belt ⇒ [page 42](#) .



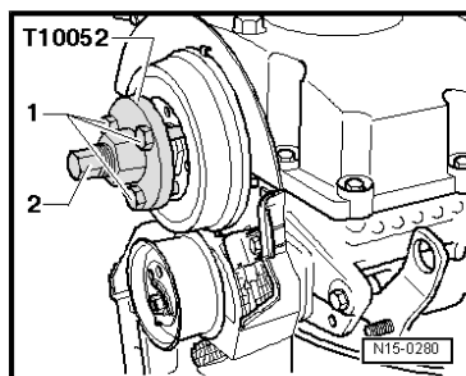
- Remove camshaft gear fastening screw. -1-.
- Remove the camshaft gear from the hub.



- Release the hub shaft fastening screw -1-.
- Use the Counterhold tool - T10051- .
- Release the hub fastening screw of approximately 2 turns.



- Install the Puller - T10052- and align it with the hub holes.
- Install the fastening screws -1- on the hub.
- Apply effort to the hub by tightening the screw evenly -2- until the hub is separated from the conic section of the camshaft.



Note

Hold the puller with a wrench when executing the operation above.

- Remove the camshaft gear hub.
- Remove the cylinder head cover.
- Remove the injector drive arm shaft.



Note

First loosen the external fastening screws, then one screw from each internal fastening screw pair and, finally, the other screw from each pair.

- Remove the auxiliary pump ⇒ [page 101](#) .
- Remove bearing caps 2 and 3. Then loosen the bearing caps 1 and 4, alternately and in cross fashion.



Note

The bearing cover 4 is identified as bearing cover 5.



2.5.2 Installation



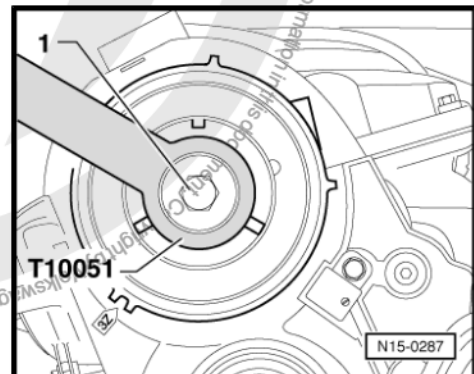
Note

- ◆ *The cams in cylinder 1 must be facing upwards when installing the cylinder head cover onto the camshaft.*
- ◆ *Do not exchange the bearing shells (mark them).*
- ◆ *When installing the camshaft, ensure the correct seating of the clamps on the bearing caps and on the cylinder head.*
- ◆ *Before installing the bearing caps, make sure the cylinder head screw washers are placed on the cylinder head.*
- Lubricate the shell bearings contact surfaces.
- Tighten bearing caps 2 and 3, alternately and diagonally, to 8 Nm + 90° (replace).
- Install bearing caps 1 and 4, and also tighten with 8 Nm + 90° (replace).



Note

- ◆ *The bearing cover 4 is identified as bearing cover 5.*
- ◆ *Use Sealant - AMV 17400401- to seal the bearing cover surfaces 1 and 4 which are in contact with the cylinder head*
⇒ [page 54](#)
- ◆ *Bearing cap 4 should be aligned with the cylinder head external edge, otherwise there can be leak in the auxiliary pump.*
- Install the camshaft sealant.
- Install the injector drive arm shaft and tighten one screw of each internal pair first, and then the other screw of each internal pair. Finally, tighten the external fastening screws alternately and evenly until there is no clearance on the bearing. In the end, apply the specified torque. Tightening torque: 20 Nm + 90° (replace).
- Install the hub on the camshaft sealant.
- Tighten the hub shaft fastening screw -1-. Tightening torque: 100 Nm.
- Use the Counterhold tool - T10051- .





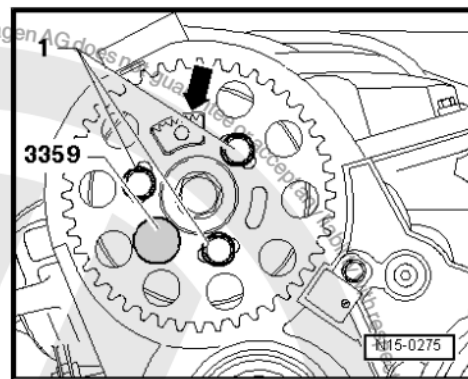
- Install the camshaft gear on the hub.



Note

The toothed segment -arrow- of the camshaft gear should be on top.

- Align the camshaft gear in a central position on the elongated holes.
- Manually tighten the fastening screws -1- of the camshaft gear so that there is no clearance.
- Immobilize the hub with the Mandrel - 3359- .
- Install and adjust the toothed belt ➔ [page 42](#) .
- Install the auxiliary pump ➔ [page 101](#) .



Note

When new tappets are assembled, the engine should not be operated for at least 30 minutes. Hydraulic compensation elements must seat (otherwise the valves will hit the pistons).



17 – Lubrication

1 Lubrication system components - remove and install



WARNING

Always replace self-locking nuts and bolts subject to angular torque



Note

- ◆ *When significant quantities of metal chips and filings appear in the engine oil during engine repair due to crankshaft and rod bearing wear, the oil filter must be replaced and the oil grooves must be carefully cleaned.*
- ◆ *The oil level should not be above the maximum mark - danger of damage to the catalyzer!*
- ◆ *All bearing or sliding surfaces should be lubricated before assembly.*

Check oil pressure ⇒ [page 72](#) .

Oil system capacity:

- ◆ With oil filter - 4.2 l.

Engine oil specification:

Only use engine oils as per specification VW 505.01.

Part I: assembly overview ⇒ [page 64](#) .

Part II: disassembly of the oil filter support ⇒ [page 67](#) .

Part III: removal and installation of the oil supply line
⇒ [page 68](#) .

Part I



1 - 15 Nm

2 - Flange

- ☐ With sealing ring.
- ☐ It needs to be positioned on the mounting guides.
- ☐ Remove and install ➔ [page 18](#).
- ☐ Install with Silicone sealant - D 176 404 A2- ➔ [page 18](#).
- ☐ Do not additionally lubricate or grease the seal lip.
- ☐ Before installation, remove oil residues from crankshaft trunnion with a clean cloth.
- ☐ Replace the crankshaft seal on the pulley side ➔ [page 18](#).

3 - Cylinder block

4 - Gasket

- ☐ Renew.

5 - Oil filter bracket

- ☐ Remove and install ➔ [page 67](#).

6 - 15 Nm + 90°

- ☐ Renew after each removal.
- ☐ First, tighten the screws left on the upper part, and on the lower part on the right. Then, tighten the four screws diagonally.

7 - Oil dipstick

- ☐ The oil level should not be above the maximum mark!
- ☐ Marks ➔ [page 69](#)

8 - Funnel

- ☐ Remove to drain oil.

9 - 5 Nm

10 - Guide tube

11 - 10 Nm

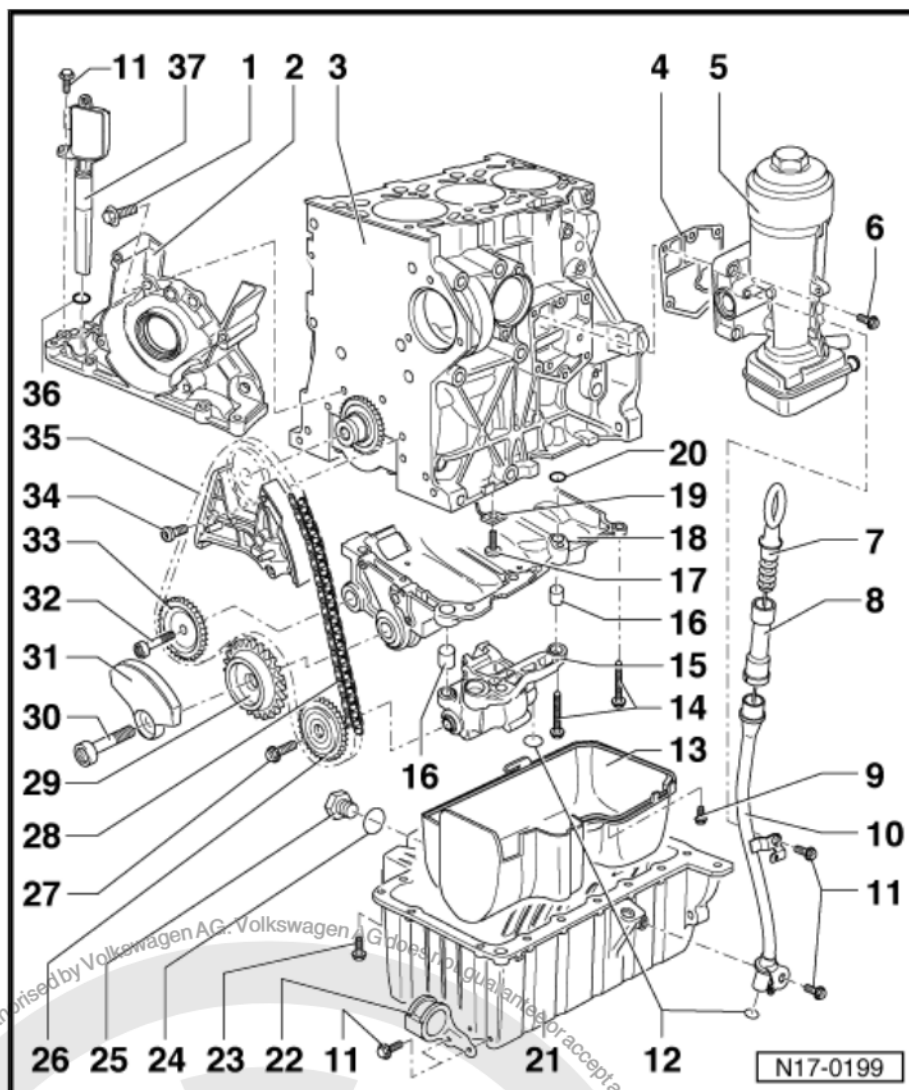
- ☐ Not applicable.

12 - Seal

- ☐ Renew.
- ☐ Check that it is firmly seated.
- ☐ Slightly lubricate when installing.

13 - Cover

- ☐ With sealing tape.
- ☐ Clean the filter, if dirty.





14 - 20 Nm

15 - Oil pump

- ☐ With 11.5 bar pressure relief valve.
- ☐ Before installation, check if the centralization guides are assembled.

16 - Fastening sleeve

17 - 25 Nm

- ☐ Install without sealant.

18 - Mounting frame

- ☐ Before installing, check that the centralization guides on the engine block are in place and that the ring is inserted in the retention frame.
- ☐ Remove and install ⇒ [page 24](#) .

19 - Oil ejector

- ☐ For piston cooling.
- ☐ Check installation position: Install by turning the oil ejector in the counterclockwise to the stop.

20 - Seal

- ☐ Renew.

21 - Crankcase

- ☐ Clean the sealing surfaces before installation.
- ☐ Install with Silicone sealant - D 176 404 A2- ⇒ [page 71](#) .
- ☐ To remove the oil pan, first remove the gearbox ⇒ Clutch and gearbox; Rep. gr. 34 ; Drive, housing .

22 - Mounting bracket

- ☐ For the intercooler hose.

23 - 15 Nm

- ☐ To remove the rear bolts near the gearbox, the gearbox needs to be removed ⇒ Clutch and gearbox; Rep. gr. 34 ; Drive, housing .

24 - Seal

- ☐ Renew.

25 - Plug, 30 Nm

- ☐ Replace draining plug with sealing.

26 - Gear

- ☐ For the oil pump.
- ☐ It can only be installed in one position.

27 - 20 Nm + 90°

- ☐ Renew after each removal.

28 - Chain

- ☐ Observe fixing position ⇒ [page 24](#) .

29 - Gear

- ☐ For the balance shaft.
- ☐ It can only be installed in one position. The holes are out of place.

30 - 100 Nm + 90°

- ☐ Renew after each removal.
- ☐ The angular torque can be performed in several stages.
- ☐ To loosen and tighten, use a Multi-point wrench - T10061- .

31 - Balance

- ☐ It can only be installed in one position. The holes are out of place.

- Part II



Always replace self-locking nuts and bolts subject to angular torque

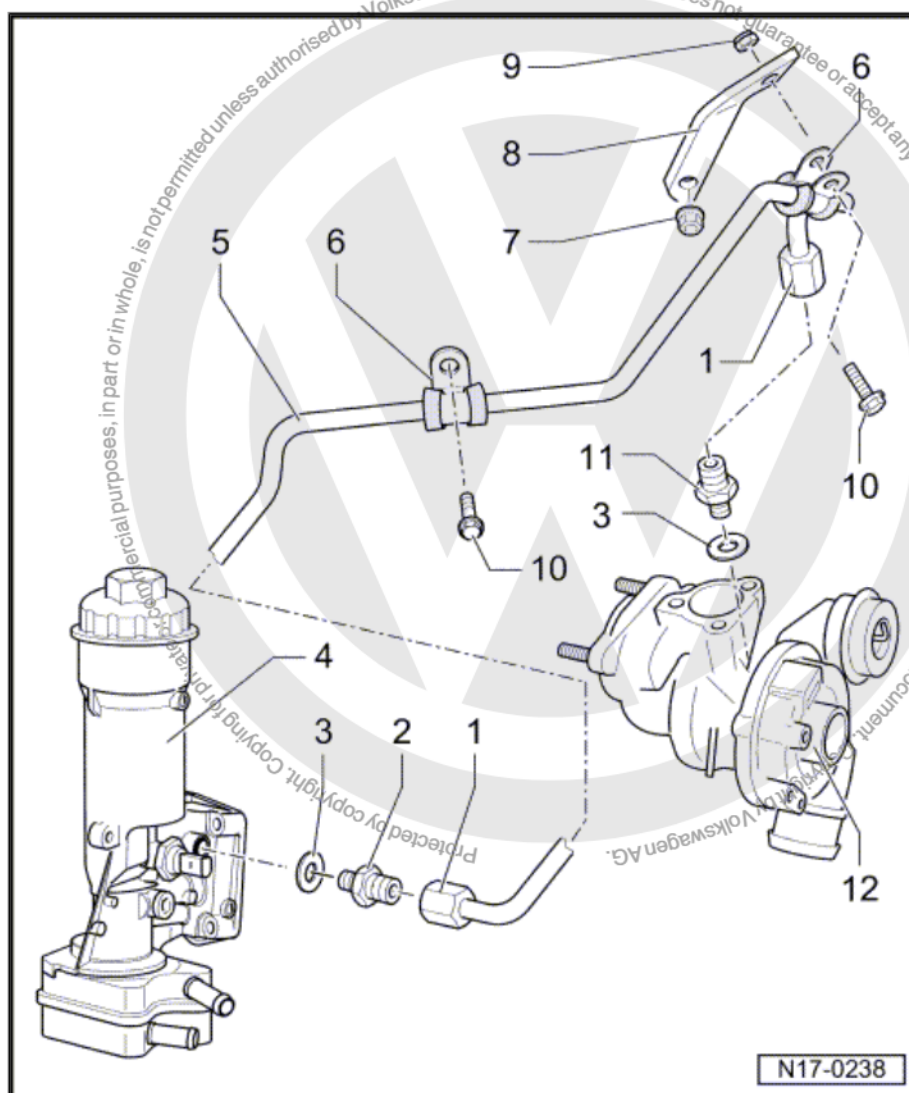
-
- Exploded view diagram of a vehicle's rear suspension assembly, showing the main body, shock absorber, and various mounting components. The diagram is numbered 1 through 15, corresponding to the parts list on the right. A watermark 'Protected by Copyright © Volkswagen AG' is visible across the diagram.
1. Main body (left side)
 2. Mounting bracket (left side)
 3. Main body (right side)
 4. Shock absorber
 5. Mounting bracket (right side)
 6. Shock absorber
 7. Mounting bracket (right side)
 8. Shock absorber
 9. Mounting bracket (right side)
 10. Shock absorber
 11. Mounting bracket (right side)
 12. Shock absorber
 13. Mounting bracket (right side)
 14. Shock absorber
 15. Mounting bracket (right side)



- 10 - Oil filter element
- 11 - Sealing plug, 10 Nm
- 12 - Gasket
 - ☐ Renew.
 - ☐ Install in the oil radiator groove.
- 13 - Oil radiator
 - ☐ Check installation position.
 - ☐ See note ⇒ [page 64](#) .
- 14 - Gasket
 - ☐ Renew.
- 15 - Sealing plug, 25 Nm

Part III

- 1 - Lock nut, 22 Nm
 - ☐ When loosening or tightening, hold the connection.
- 2 - Connection
 - ☐ Remove and install ⇒ [Item 5 \(page 67\)](#) .
- 3 - Seal
 - ☐ Renew.
- 4 - Oil filter bracket
- 5 - Oil supply line
 - ☐ For the turbocharger.
- 6 - Clip
- 7 - 25 Nm
 - ☐ Renew.
- 8 - Mounting bracket
- 9 - 10 Nm
- 10 - 10 Nm
- 11 - Connection
 - ☐ Remove and install ⇒ [Item 20 \(page 107\)](#) .
- 12 - Turbocharger





Marks on the oil dipstick

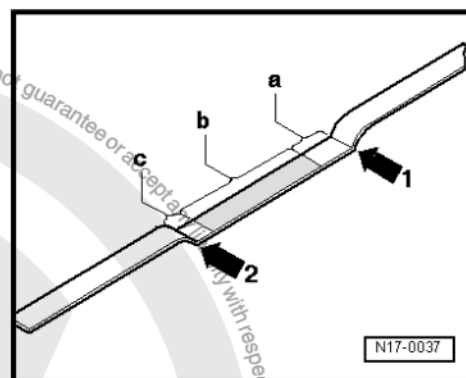
1 - max. mark

2 - min. marks

a - Region between the upper corner of the engraved region and the max. mark: do not refill with oil.

b - Oil level in the hatched field: May be filled with oil.

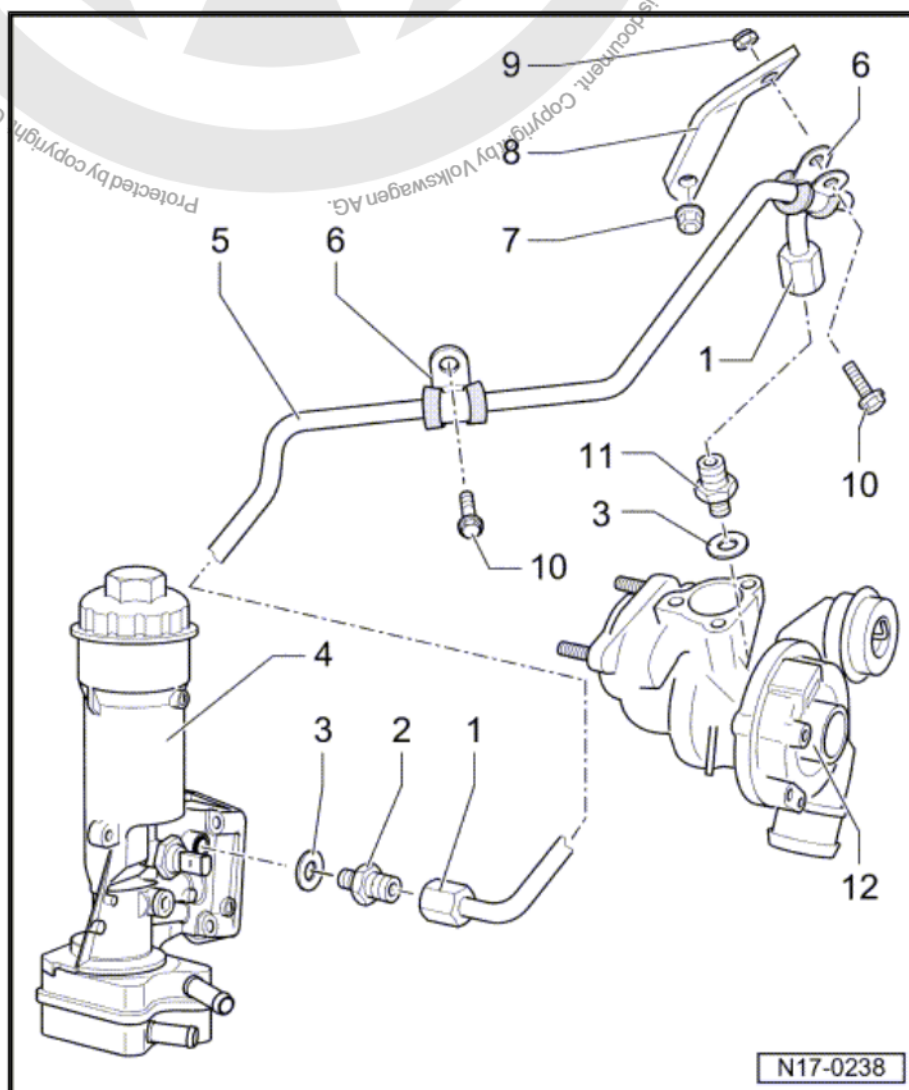
c - Area between min. mark and lower corner of hatched area: Replenish with at most 0.5 litre of engine oil.



Assembly sequence

Removal

- Remove the noise insulation.
- Place Drip tray - V.A.G 1306- underneath.
- To remove, loosen the clamps -6- from the supply hose.
- Disconnect the lock nut -1- on the oil filter support -4-, locking the connection -2-.
- Remove the screw -10- on the rear side of the engine.





- Remove the lock nut -1- on the turbocharger -12- locking the connection -11-.
- Remove the screw -10- from the support -8-.
- Remove the nut -7- and the support -8-.
- Remove the oil supply line -5-.

Installation

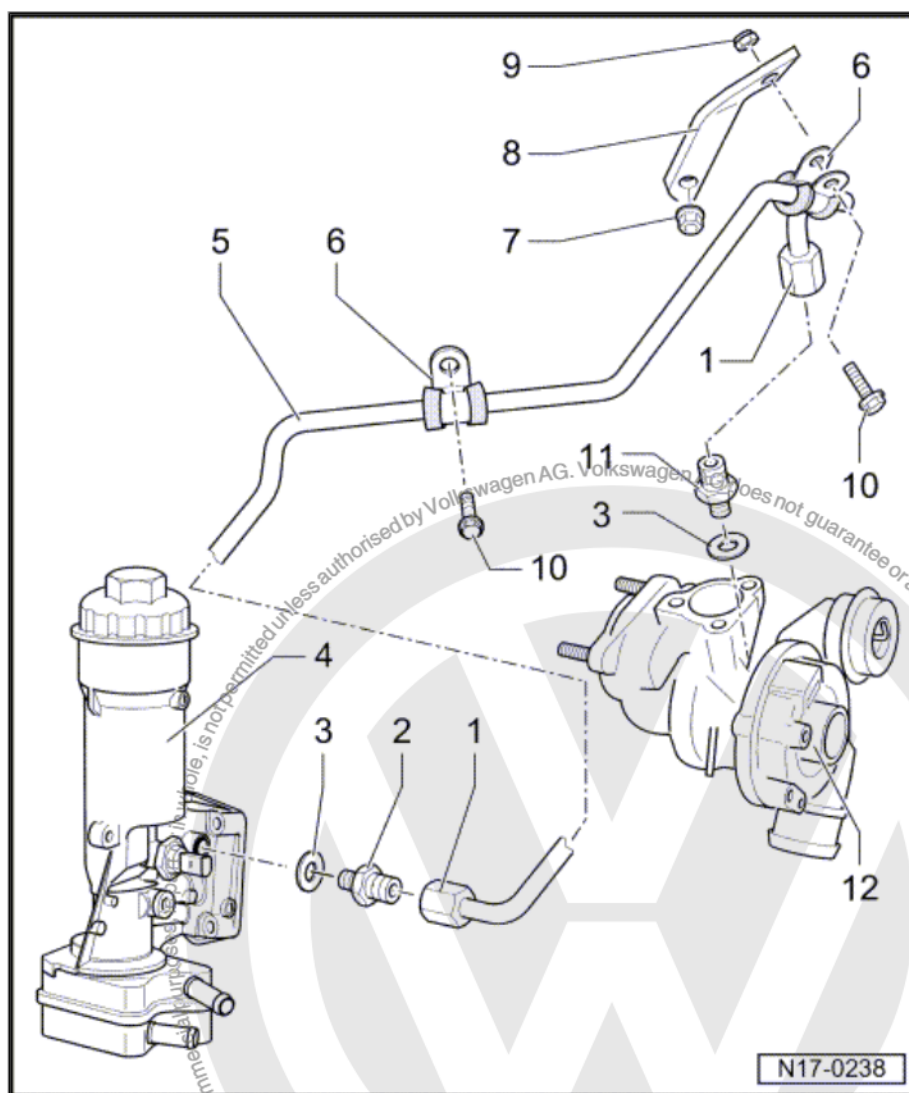
Install in the opposite sequence, observing the following:



WARNING

The oil supply line assembly should be done as described below.

- Slightly screw the support -8- with the nut -7- on the exhaust manifold.



- Tighten the lock nut -1- on the connection -2- of the oil filter support -4- manually.



- Tighten the lock nut -1- on the connection -11- of the turbo-charger -12- manually.
- Tighten the lock nut -1- on the oil filter support -4- with tightening torque, locking the connection -2-.
- Tighten the lock nut -1- on the turbocharger -12- with tightening torque, locking the connection -11-.
- Position the clamps -6- on the oil supply line -5-.
- Tighten bolt -10-.
- Tighten nut -7-.

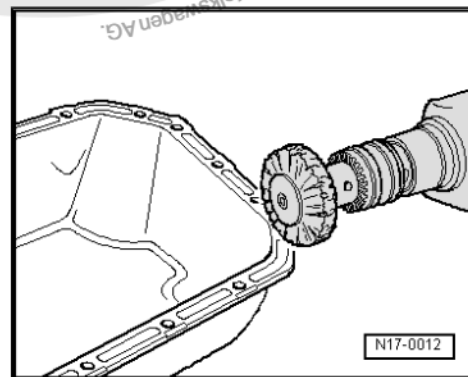
1.1 Oil pan- remove and install

Special tools and workshop equipment required

- ◆ Portable drilling machine with plastic brush
- ◆ Silicone sealant - D176404 A2-
- ◆ Flat spatula

1.1.1 Removal

- Remove the lower noise insulation from the engine ⇒ Body - External assembly works; Rep. gr. 50 ; Body - front part .
- Drain engine oil.
- Remove gearbox ⇒ Clutch and gearbox; Rep. gr. 34 ; Drive, housing .
- Remove crankcase.
- If necessary, loosen the crankcase by tapping it slightly with a rubber hammer.
- Eliminate residues of seal remaining on the engine block with a flat spatula.
- Eliminate residues of sealant from the crankcase and its cover with a rotary brush, for example, a plastic brush attached to a portable drill (wear protective goggles).
- Clean the sealing surfaces. They must be free of oil and grease.



1.1.2 Installation



Note

- ◆ Check the sealant expiry date.
- ◆ The crankcase should be installed within 5 minutes after applying the sealant.



- Cut the cartridge nozzle at the foremost marking (\varnothing of nozzle to be approx. 3 mm).
- Apply the silicone sealant as illustrated on the clear sealing surface of the oil pan. The sealant cord should:
 - ♦ Be 2...3 mm thick.
 - ♦ Go through the inside of the area around the screw holes -arrows-.



Note

The sealant cord cannot be thicker, or else the excessive sealant can go to the oil pan and obstruct the oil suction tube sieve.

- Install the crankcase immediately and tighten all the screws slightly.



Note

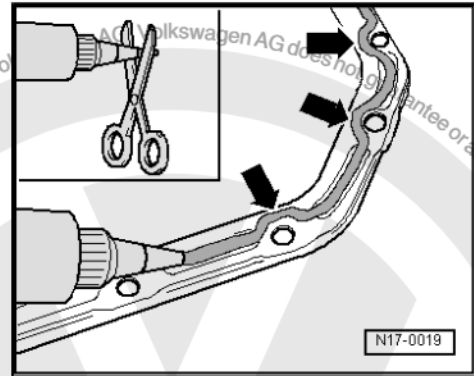
The crankcase should be aligned with the engine block.

- Tighten screws to 15 Nm.
- Install transmission ⇒ Clutch and transmission; Rep. gr. 34 ; Drive, case .
- Tighten crankcase/gearbox screws to 45 Nm.



Note

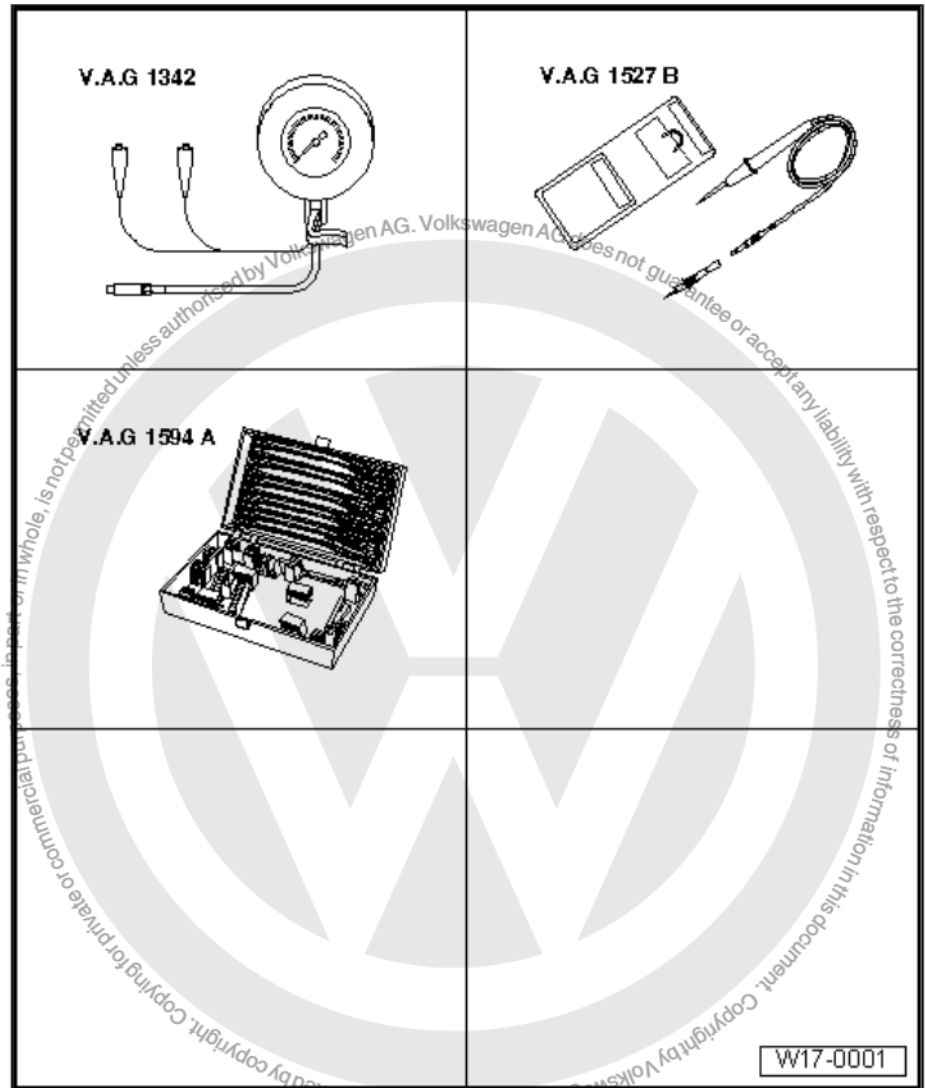
After the sump is installed the sealant must dry for about 30 minutes before replenishing with engine oil.



1.2 Check the oil pressure and the oil pressure switch



Special tools and workshop
equipment required



- ◆ Oil pressure gauge - V.A.G 1342-
- ◆ Test probe - VAG 1527B-
- ◆ Auxiliary measuring cable set - VAG 1594C-



Note

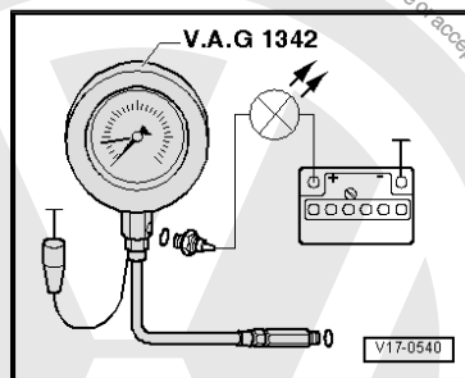
Operation and maintenance test of visual and acoustic oil pressure indicator ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



Test sequence

- Remove the Oil pressure switch - F1- and screw in the test device.
- Install the test device in the place of the oil pressure switch in the oil filter support.
- Connect the brown cable of the test device in the earth (-).
- Connect the Test probe - VAG 1527B- using the Auxiliary measuring cable set - VAG 1594C- to the positive terminal of the battery (+) and Oil pressure switch - F1- .
- Turn the engine on and slowly increase its rotation. The LED should turn off at between 0.55...0.85 bar; otherwise, replace the oil pressure switch .
- Continue increasing engine speed. At 2000 rpm and an oil temperature of 80°C, the oil pressure should be at least 2.0 bar.

At higher speeds, oil pressure must not exceed 5.8 bar. If necessary, replace the oil filter support.





19 – Cooling

1 Cooling system components - remove and install



Note

- ◆ *The cooling system is under pressure when the engine is hot. Thus, it is necessary to reduce the pressure before conducting repairs.*
- ◆ *Hose connection are fastened by spring clamps. For repairs, use spring clamps only.*
- ◆ *To install the spring clamps, we recommend using the Standard-type clamp pliers - VAS 5024A- or the Pliers - VAG 1921-.*

Check tightness of the cooling system with the Engine cooling system analyzer - VAG 1274- and with the Adapter for VAG 1274 - VAG 1274/8- and Adapter for VAG 1274 - VAG 1274/9- .

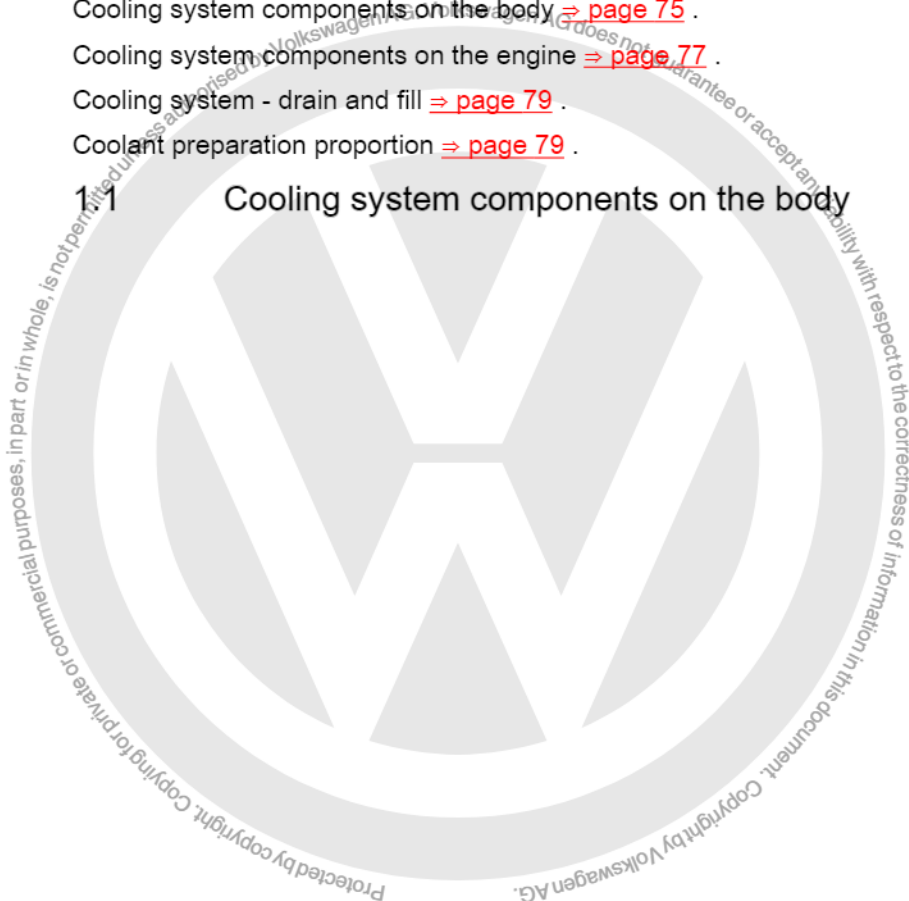
Cooling system components on the body ⇒ [page 75](#) .

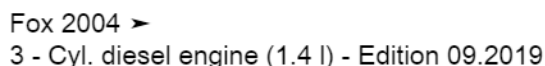
Cooling system components on the engine ⇒ [page 77](#) .

Cooling system - drain and fill ⇒ [page 79](#) .

Coolant preparation proportion ⇒ [page 79](#) .

1.1 Cooling system components on the body





- ❑ Remove and install
⇒ page 82 .
- ❑ When replacing, re-
place all coolant.

- ❑ Replace it if damaged.

- ❑ Hose connection diagram \Rightarrow page 78 .

- ❑ Check with the engine cooling system analyzer - VAG 1274- and with the Adapter for VAG 1274 - VAG 1274/9-
- ❑ Test pressure 1.4...1.6 bar.

- 6 - 5 Nm

- Check tightness of the cooling system with the engine cooling system analyzer - VAG 1274- and with the Adapter for VAG 1274 - VAG 1274/8- .

- 9 - 5 Nm

- 10 - Fan ring

- 11 - 10 Nm

- 12 - Radiator fan

- 13 - Mounting bracket

- ❑ For the radiator fan connector.

- 14 - Lower hose of the cooling system

❑ Hose connection diagram ⇒ [page 78](#).

- 15 - Radiator fan thermal switch - F18- , 35 Nm

☐ From electrical fan.

☐ Starting temperatures: Stage 1, on: 92 ... 97 °C off: 84...91 °C. Step 2 On: 99 ... 105 °C off: 91...98 °C.

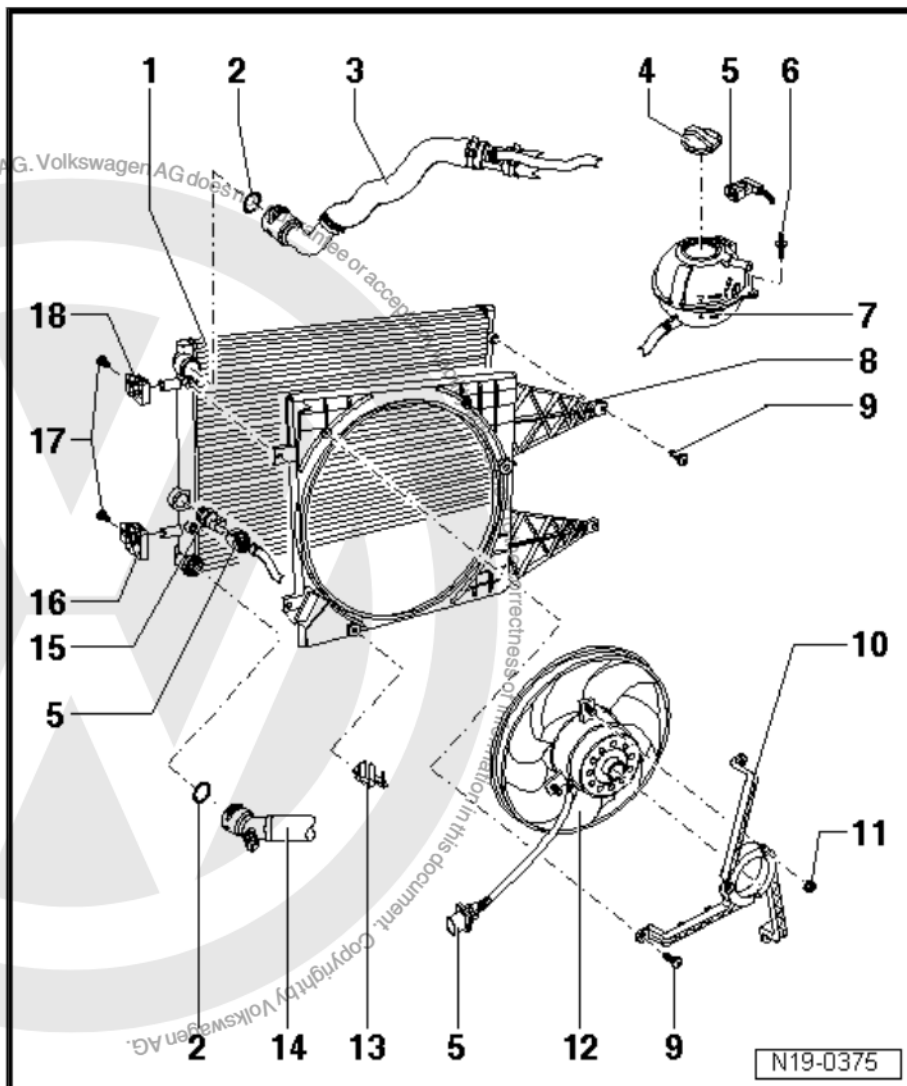
- ## 16 - Lower radiator support

☐ Black.

- 17 - 5 Nm

- 18 - Radiator upper support

☐ White.



1.2 Cooling system components in the engine

1 - Hose

- ☐ To heat exchanger.

2 - Connection

3 - 10 Nm

4 - Hose

- ☐ From the heat exchanger.
- ☐ Hose connection diagram ⇒ [page 78](#).

5 - 25 Nm

6 - Hose

- ☐ To the lower part of the coolant tank.
- ☐ Hose connection diagram ⇒ [page 78](#).

7 - Mounting bracket

8 - Cooling system tube

- ☐ Hose connection diagram ⇒ [page 78](#).

9 - Seal

- ☐ Renew.

10 - Hose

- ☐ From the upper part of the expansion tank.
- ☐ Hose connection diagram ⇒ [page 78](#).

11 - Hose

- ☐ To the top of the radiator.
- ☐ Hose connection diagram ⇒ [page 78](#).

12 - Hose

- ☐ From the lower part of the radiator.
- ☐ Hose connection diagram ⇒ [page 78](#).

13 - Connection

- ☐ For the thermostat.

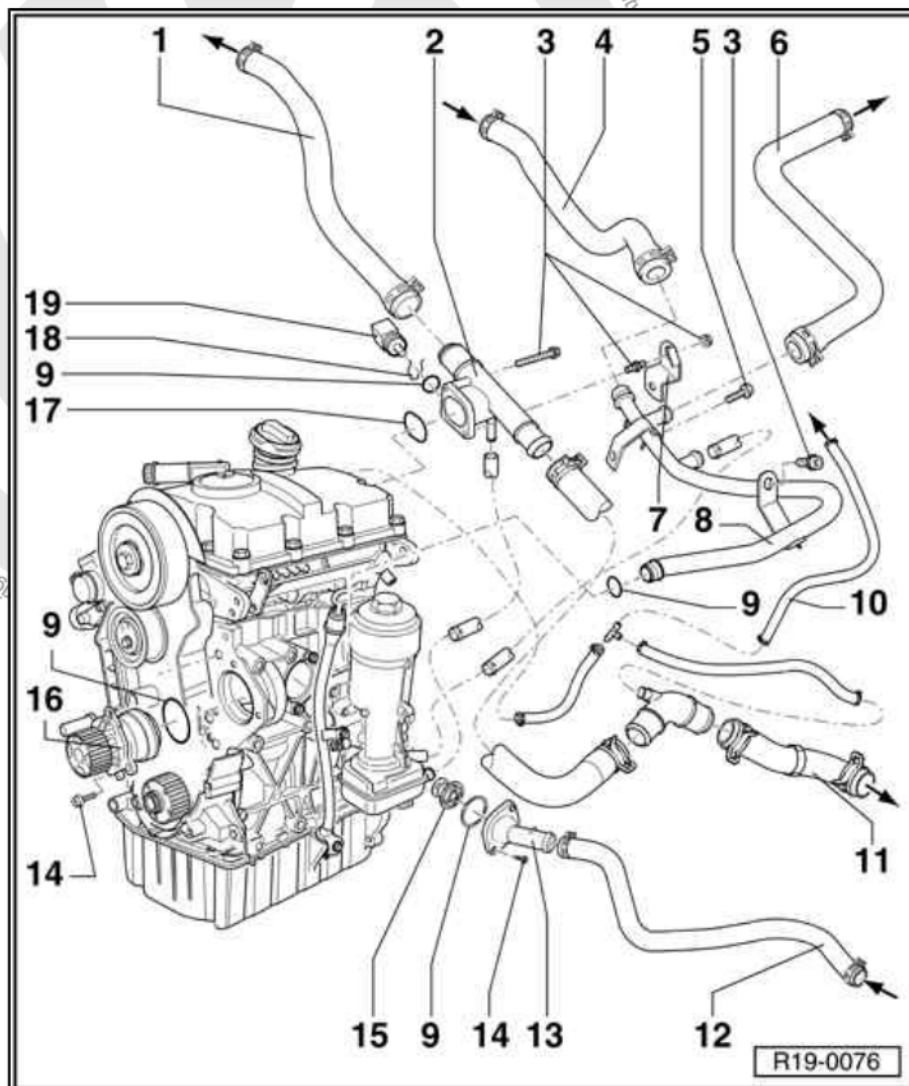
14 - 15 Nm

15 - Thermostat

- ☐ Remove and install ⇒ [page 85](#).
- ☐ Note the installation position ⇒ [page 85](#).
- ☐ Verification: heat the thermostat in water.
- ☐ The opening starts at approximately 85 °C.
- ☐ It ends at approximately 105 °C.
- ☐ Minimum opening travel 7 mm.

16 - Water pump

- ☐ Check the easiness to move.
- ☐ Check installation position.





- ☐ Remove and install ⇒ [page 83](#) .

17 - Seal

- ☐ Check that it is firmly seated.
- ☐ Renew.

18 - Clip

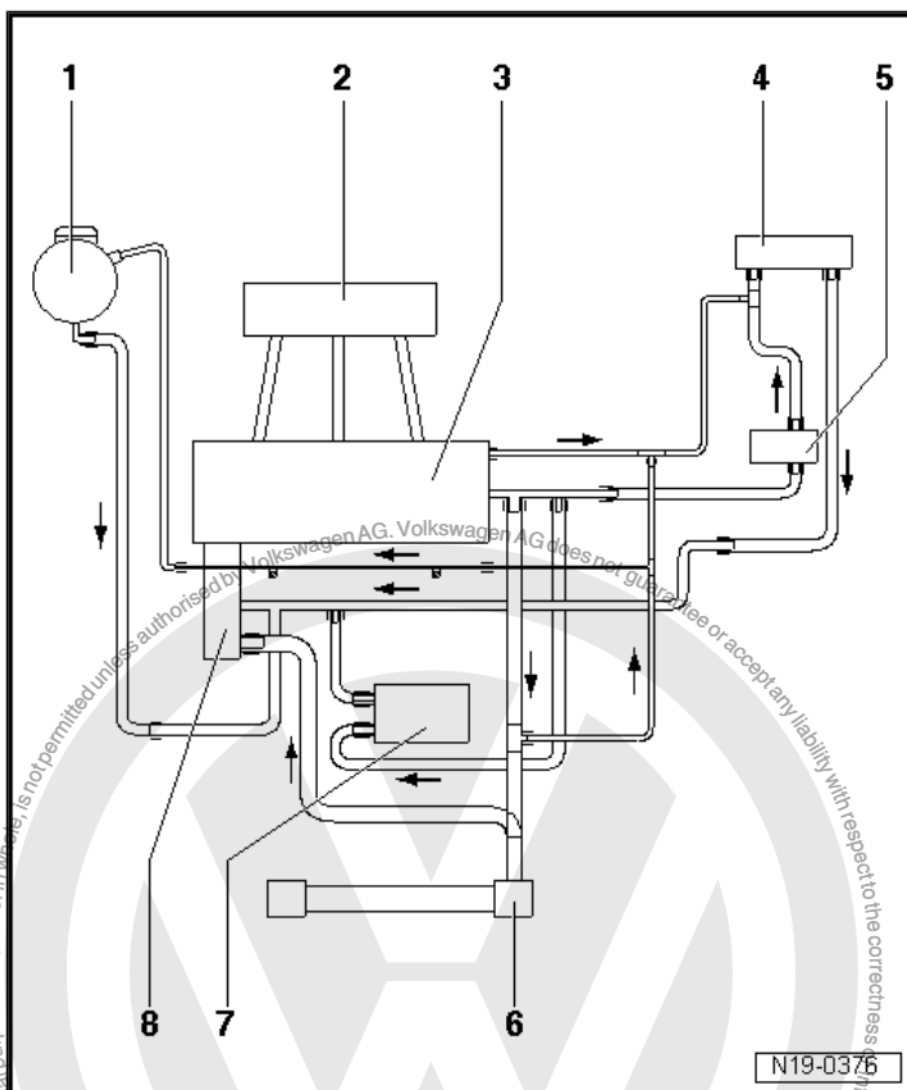
- ☐ Check that it is firmly seated

19 - Coolant temperature sensor - G62- .

- ☐ With Coolant temperature sensor - G2- .

1.3 Hose connection diagram for cooling system

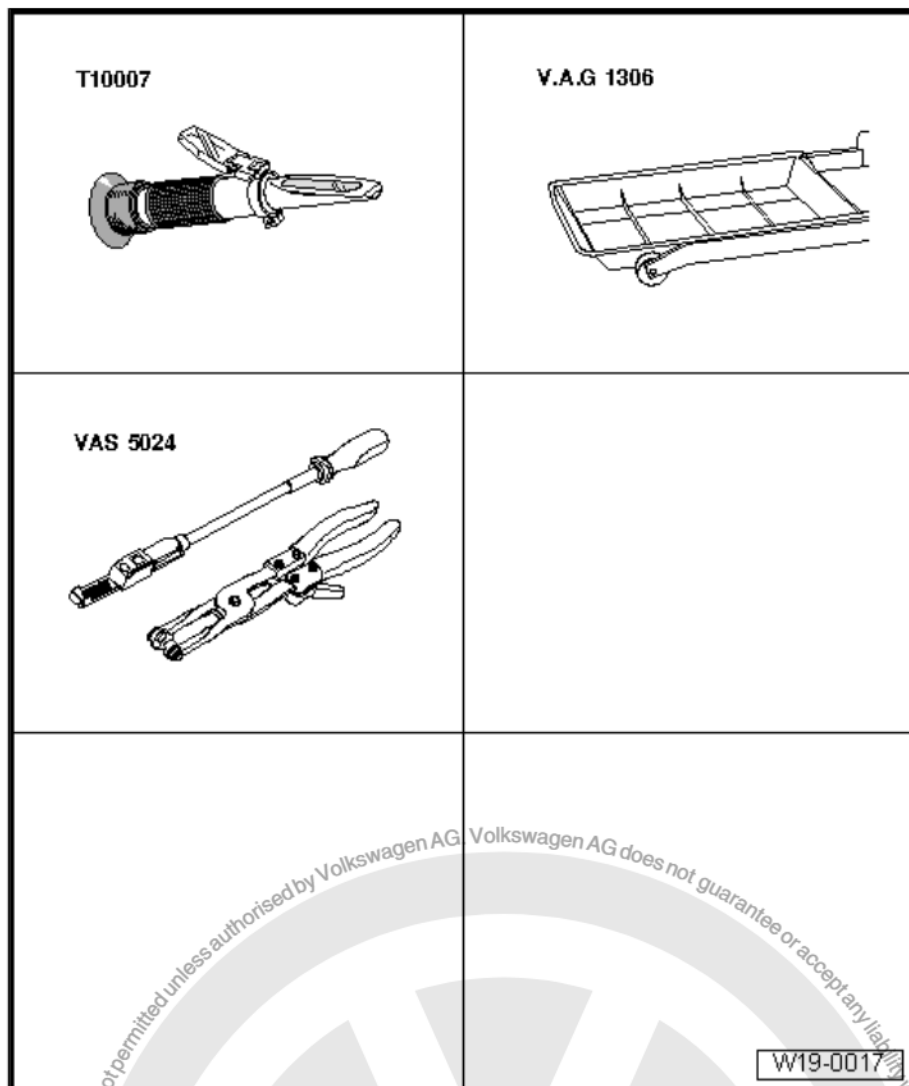
- 1 - Coolant reservoir
- 2 - Intake manifold
- 3 - Engine block/cylinder head
- 4 - Heating system heat exchanger
- 5 - Radiator
 - ☐ To recirculate the exhaust gases.
- 6 - Radiator
- 7 - Oil radiator
- 8 - Water pump/thermostat





1.4 Cooling system - drainage and replenishment

Special tools and workshop equipment required



- ◆ Refractometer - T10007A-
 - ◆ Drip tray - V.A.G 1306-
 - ◆ Spring-type clip pliers - VAS 5024A-
- No illustration:
- ◆ Cooling system charge unit - VAS 6096-

1.4.1 Drain

- Remove coolant expansion tank lid.



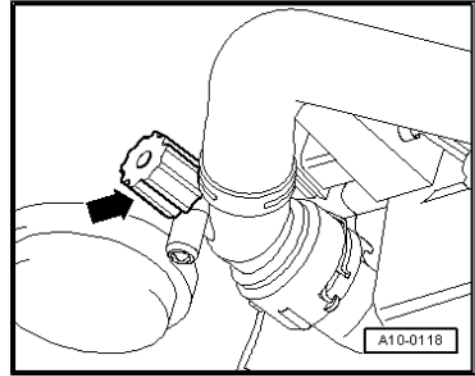
WARNING

There can be steam when the coolant tank lid is open; cover the lid with a cloth and open it carefully.

- Remove the lower noise insulation from the engine ⇒ Body - External assembly works; Rep. gr. 50 ; Body - front part .



- Remove the plug -arrow- to drain the cooling system.

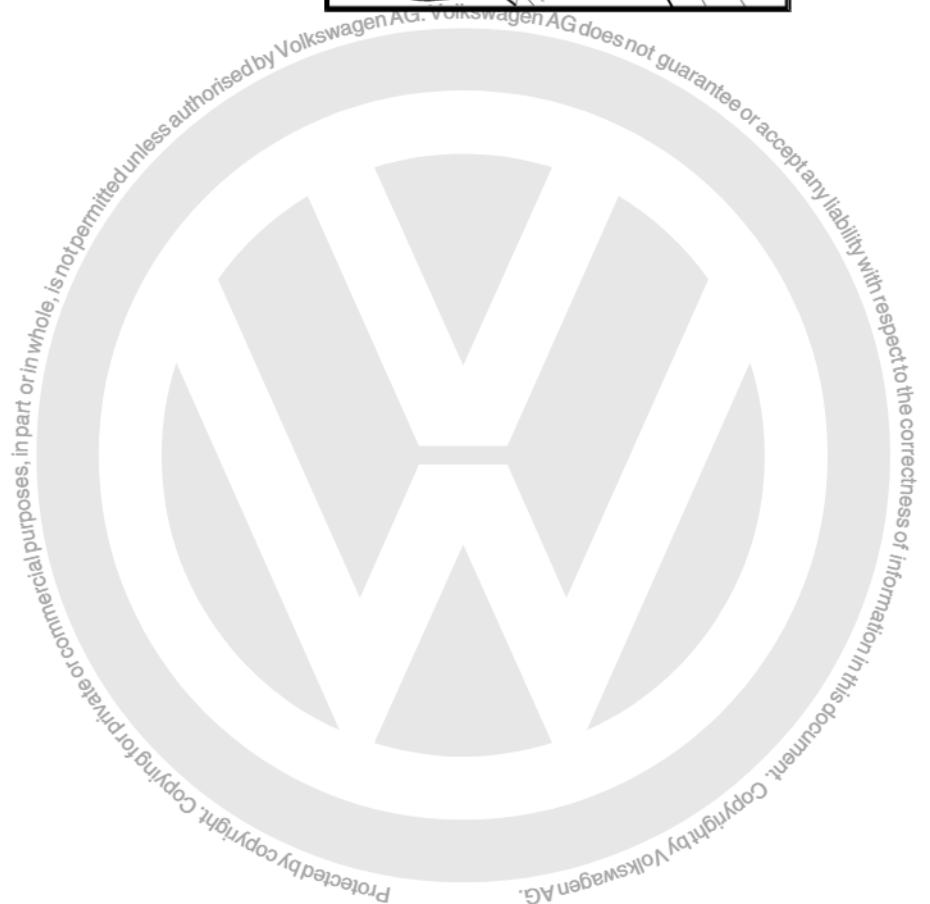
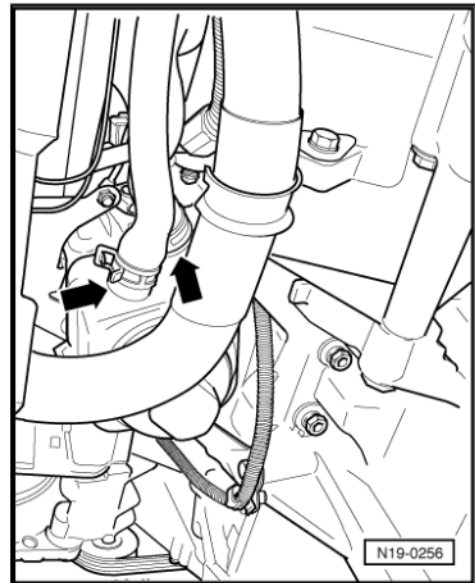


- , Also release the oil radiator hose -arrows-.



Note

Follow the recommendations for coolant disposal!





1.4.2 Replenishing



Note

- ◆ According to the TL 774 J standard, only G13 antifreeze additive Coolant additive - G 013 A8J M1- is allowed. It is identified by the red colour.
- ◆ Never mix, under any circumstances, G13 Coolant additive - G 013 A8J M1- with other antifreeze additives.
- ◆ If the fluid in the reservoir is brown, it indicates that the G13 Coolant additive - G 013 A8J M1- got mixed with another antifreeze. In that case, renew the coolant entirely.
- ◆ The G13 Coolant additive - G 013 A8J M1- and antifreeze additives labelled "compliant with TL 774 J", prevent damages resulting from corrosion, freezing or calcium sedimentation in addition to further increase the boiling temperature of the coolant. Therefore, the cooling system must always have the recommended mixture of antifreeze and anti-corrosion products.
- ◆ Due to the high boiling temperatures it provides, antifreeze is especially helpful in tropical countries, ensuring safe operation when the engine is submitted to heavy-duty work.
- ◆ Antifreeze protection must be assured to approximately -25 °C (in countries with Arctic climates, to approximately -35 °C).
- ◆ Coolant concentration must not be diluted by adding water during hot seasons, or in countries with hot climates. The percentage of antifreeze should be at least 40 %.
- ◆ If the climate requires higher antifreeze protection, the percentage of G13 Coolant additive - G 013 A8J M1- may be increased, but only up to the limit of 60 % (antifreeze protection down to -40 °C). The higher proportion lowers cooling capacity and antifreeze protection.
- ◆ In order to determine the antifreeze protection density, use the Refractometer - T10007A- .
- ◆ Do not reuse old coolant when replacing the radiator, heat exchanger, cylinder head or cylinder head gasket.
- ◆ Use only clean drinkable water to prepare the coolant.

Recommended proportions:

Antifreeze protection up to	Antifreeze proportion	G 13 ²⁾	Water ²⁾
-25 °C	40 %	2,0 l	3,0 l
-35 °C	50 %	2,5 l	2,5 l

2) The coolant volume may vary according to the equipment on each vehicle.

- Close the drainage plug of the cooling system.
- Connect the hose of the cooling system to the oil radiator.
- Install the lower engine noise insulation ⇒ Body - External assembly works; Rep. gr. 50 ; Body - front part

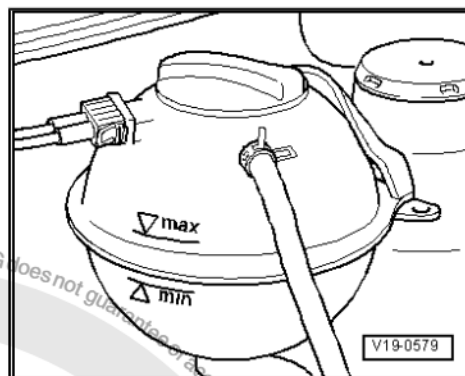
With the Cooling system charge unit - VAS 6096- :

- Install the adapter of the Engine cooling system - VAG 1274- according to the vehicle in the coolant tank.
- Fill the cooling system with the Cooling system supply unit - VAS 6096- ⇒ Operation instructions for the Cooling system supply unit - VAS 6096- .



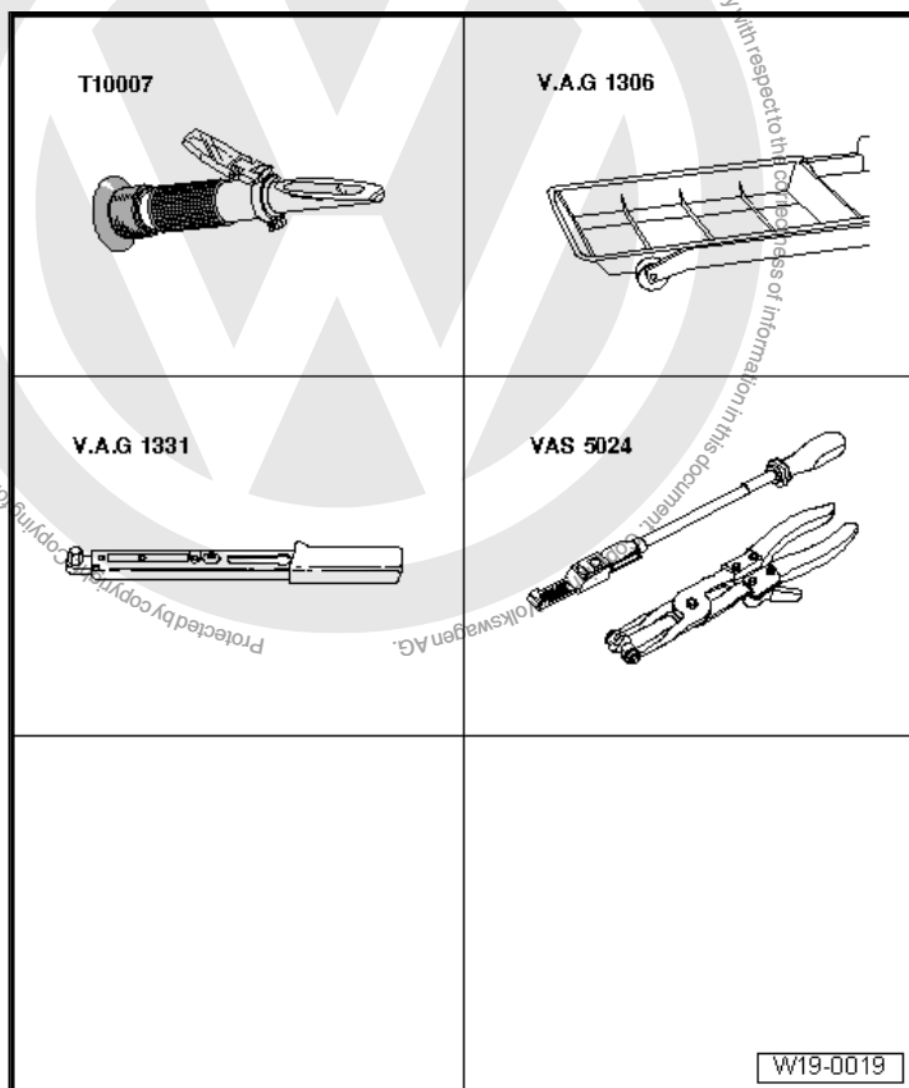
Without Cooling system charge unit VAS 6096 - VAS 6096 - :

- Fill with coolant until the maximum mark at the expansion tank.
- Put the coolant tank cap.
- Turn off heating start device.
- Start the engine and maintain a speed of about 2000 rpm for approx. 3 minutes.
- Run the engine until the Radiator fan starts.
- Check coolant level and, if necessary, top it up. When the engine is hot, the coolant level should be on the max. marking; when the engine is cold, it should be between max. and min. marks.



1.5 Radiator - remove and install

Special tools and workshop equipment required



- ◆ Refractometer - T10007A-
- ◆ Drip tray - V.A.G 1306-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Spring-type clip pliers - VAS 5024A-



1.5.1 Removal

- Remove the front bumper ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumpers .
- Put front panel in work position: ⇒ General body repairs, exterior; Rep. gr. 50 ; Body - front part .
- Drain cooling system ⇒ [page 79](#) .
- Remove cooling system hoses from radiator.
- Disconnect the thermal switch and the radiator fan connector.
- Remove the radiator securing bolts and remove the radiator with fan from below.

Vehicles with air conditioning system:

- Observe the additional information and removal instructions ⇒ [page 9](#) .

1.5.2 Installation

Installation is carried out in the opposite sequence of the removal, whilst observing the following:

- Replenish cooling system ⇒ [page 79](#) .

Vehicles with air conditioning system:

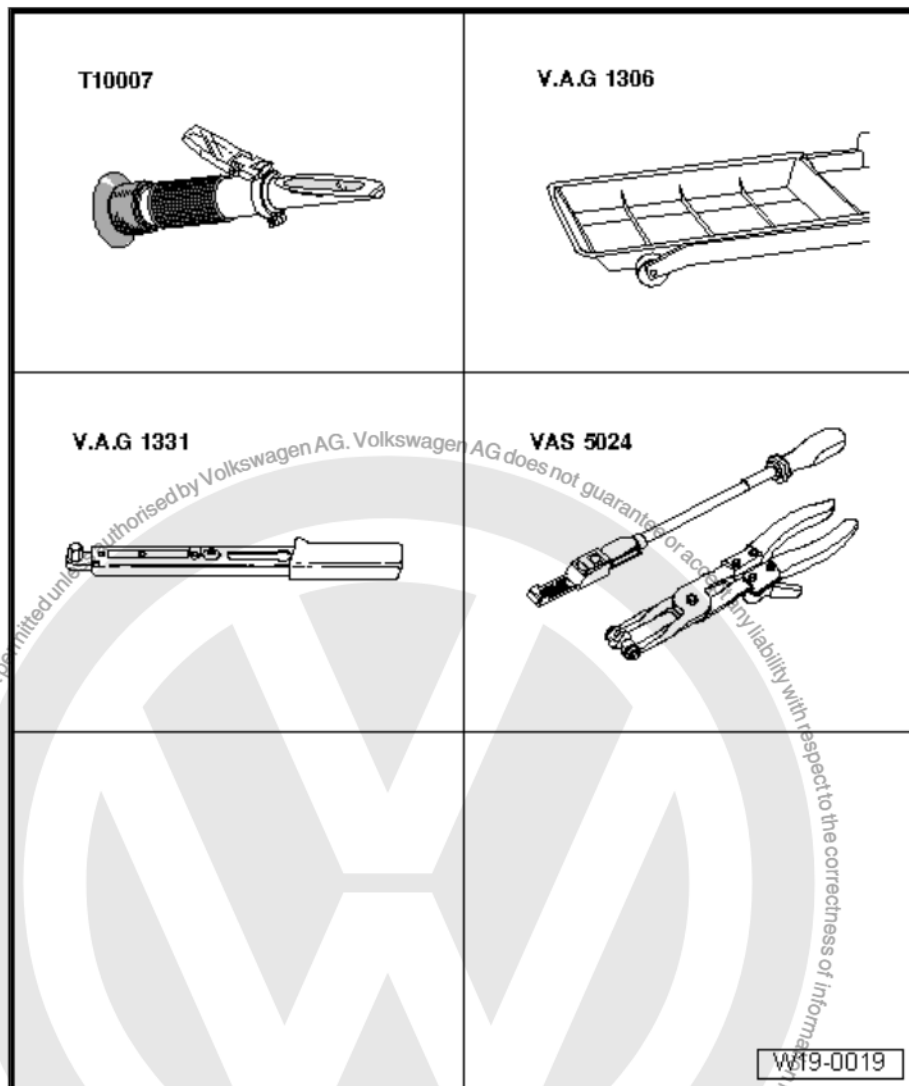
- Observe the additional information and removal instructions ⇒ [page 9](#) .

1.6 Water pump - remove and install





Special tools and workshop
equipment required



- ◆ Refractometer - T10007A-
- ◆ Drip tray - V.A.G 1306-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Spring-type clip pliers - VAS 5024A-

1.6.1 Removal



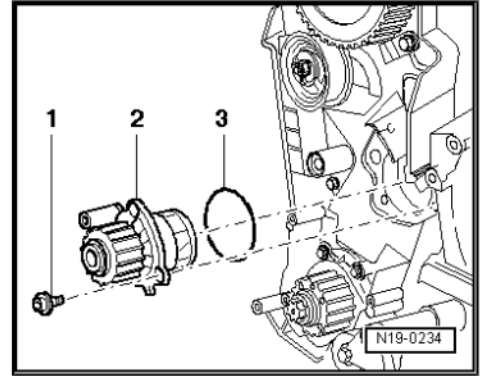
Note

Always replace the gaskets and seals.

- Drain cooling system ➔ [page 79](#) .
- Remove the Poly-V belt ➔ [page 15](#) .
- Remove toothed belt ➔ [page 42](#) .



- Loosen the fastening screws -1- and remove the pump-2- carefully.



1.6.2 Installation

Installation is carried out by in reverse order of the removal sequence, whilst observing the following:

- Moisten a new sealing ring -3- with the coolant.
- Assemble the pump -2- on the engine block and tighten the fastening screws -1-. Tightening torque: 15 Nm.



Note

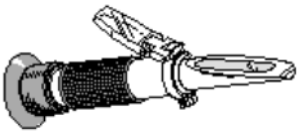
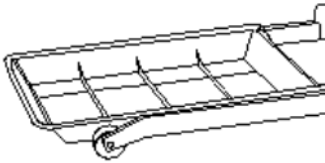
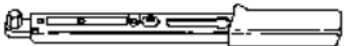
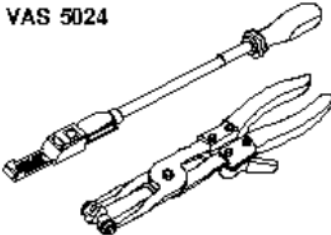
The pump plug should point downwards.

- Install and adjust the toothed belt ⇒ [page 42](#) .
- Install Poly-V belt ⇒ [page 15](#) .
- Replenish cooling system ⇒ [page 79](#) .

1.7 Thermostat - remove and install



Special tools and workshop
equipment required

T10007 	V.A.G 1306 
V.A.G 1331 	VAS 5024 
<div>W19-0019</div>	

- ◆ Refractometer - T10007A-
- ◆ Drip tray - V.A.G 1306-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Spring-type clip pliers - VAS 5024A-

1.7.1 Removal



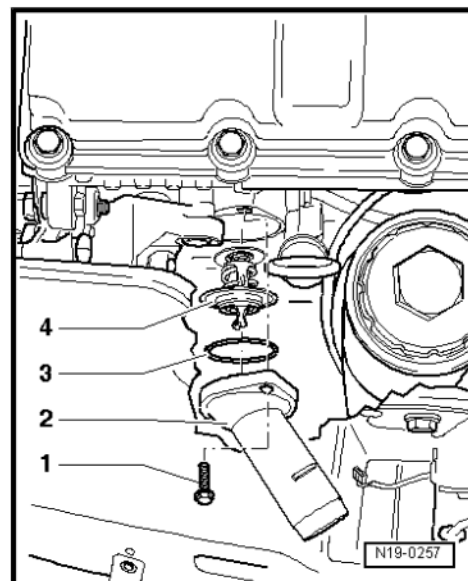
Note

Always replace the gaskets and seals.

- Drain cooling system ⇒ [page 79](#) .
- Remove the alternator ⇒ Electrical equipment; Rep. gr. 27 ;
Starter, alternator, battery .
- Remove the cooling system hose from connecting flange.



- Loosen the fastening bolts -1- of the connecting flange -2- and remove the connecting flange -2- with the thermostat -4-.
- Turn the thermostat -4- $\frac{1}{4}$ again to the left (90°) and remove the connecting flange -2-.



1.7.2 Installation

Installation is carried out by in reverse order of the removal sequence, whilst observing the following:

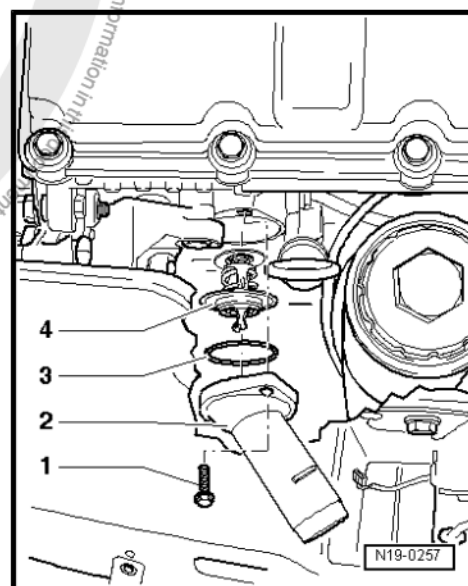
- Moisten a new sealing ring -3- with the coolant.
- Insert the thermostat -4- on the connecting flange -2- and turn $\frac{1}{4}$ again to the right (90°).



Note

The thermostat support should be almost in a vertical position.

- Assemble the connecting flange -2- with the thermostat -4- on the engine block.
- Tighten the fastening screws -1-. Tightening torque 15 Nm.
- Replenish cooling system ⇒ [page 79](#).





20 – Fuel supply system

1 Fuel supply system components - removal and installation



Note

- ♦ The hose connections are fastened by spring or clip clamps.
- ♦ Always replace tightening clamps with spring clamps.
- ♦ To install the spring clamps, we recommend using the Standard-type clamp pliers - VAS 5024A-.

Follow safety measures ➔ [page 92](#) .

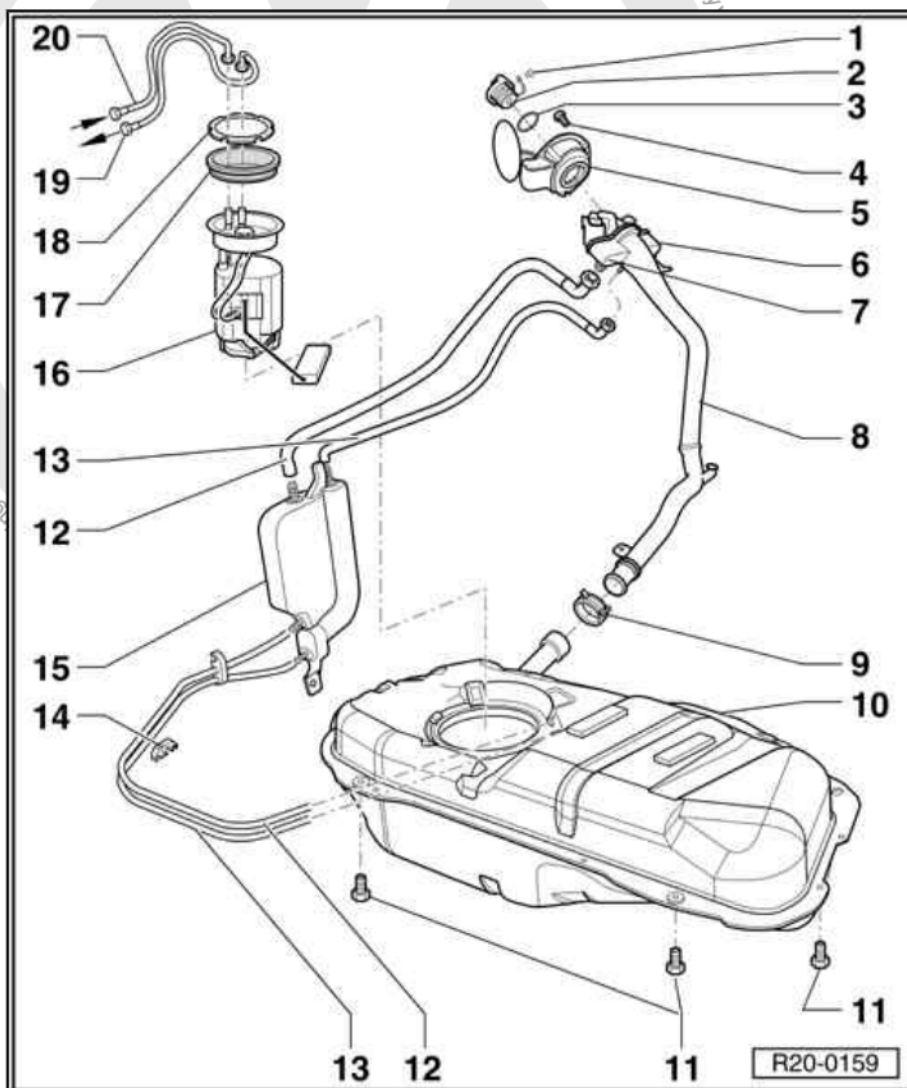
Follow cleaning rules ➔ [page 92](#) .

Repair fuel filter ➔ [page 90](#) .

Repair the accelerator mechanism ➔ [page 98](#) .

1.1 Fuel tank components with accessories - remove and install

- 1 - Fastening clip
- 2 - Cap
- 3 - Seal
 - ☐ With rubber bellows.
 - ☐ Remove and install.
- 4 - Fastening screw
- 5 - Fuel tank cap
 - ☐ With rubber bellows.
 - ☐ Remove and install ➔ General body repairs, exterior; Rep. gr. 55 ; Caps .
- 6 - Vent valve
 - ☐ Checking ➔ [page 90](#)
 - ☐ To remove the valve, open the clamp outwards the support.
 - ☐ To remove and install, remove the fuel supply line.
- 7 - Gravity valve
 - ☐ For removal, remove the cover of the right rear wheel housing.
 - ☐ To remove, release the lock latch and release the valve upwards and outwards the filling nozzle.
 - ☐ Check the valve for passage. Vertical valve: open, valve inclined 45°:





closed.

8 - Fuel supply line

9 - Spring clip

10 - Fuel reservoir

- ☐ Use a Jack for Gearbox or engine + gearbox assembly - VAG 1383A- when removing.
- ☐ Remove and install ➔ [page 93](#) .

11 - 23...29 Nm

12 - Vent hose

- ☐ Check that it is firmly fitted.

13 - Vent hose

- ☐ To the gravity valve.
- ☐ Check that it is firmly fitted.

14 - Bearing

15 - Expansion tank

16 - Fuel pump

- ☐ Check the flange installation position in the fuel tank ➔ [page 90](#)
- ☐ Remove and install ➔ [page 95](#) .
- ☐ Check fuel pump ➔ [page 97](#) .
- ☐ With the fuel gauge sensor -G-.
- ☐ Removal and installation of the fuel tank gauge sensor ➔ [page 96](#) .
- ☐ Clean sieve, whenever dirty.

17 - Seal

- ☐ Renew.
- ☐ Moisten with fuel when installing the pump.

18 - Retaining ring

- ☐ Remove and install with Spanner - VW 5321/9-

19 - Supply tubes

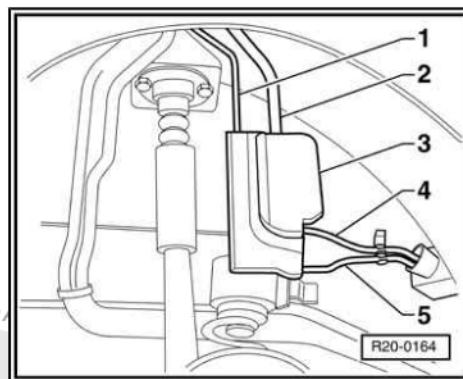
- ☐ To the fuel filter ➔ [Item 1 \(page 91\)](#) .
- ☐ Clamped to the fuel tank.
- ☐ Check that it is firmly fitted.
- ☐ Black.
- ☐ Press the release button on the connecting part to remove the flange.

20 - Return hose

- ☐ Blue or blue-marked.
- ☐ Clamped to the fuel tank.
- ☐ Check that it is firmly fitted.
- ☐ To remove the flange, press the release button on the connecting part.



- 1 - To the pressure relief valve.
- 2 - To the gravity valve.
- 3 - Expansion reservoir.
- 4 - Vent hose (From the fuel tank).
- 5 - Choke unloader tube (From the fuel tank).



Fuel pump installation position

The flange mark should be aligned with the fuel tank mark -arrow-.

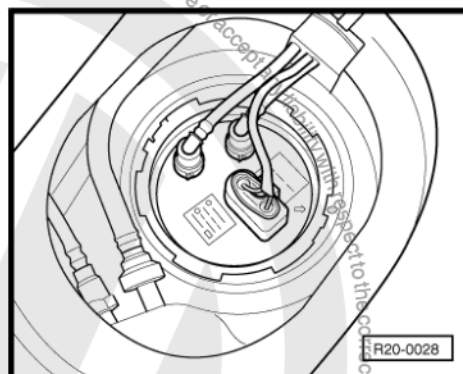
Blue or blue marked return line -1- connected to the joint identified with an -R-.

Black supply line -2- connected to the connection identified with a -V-.



Note

After installing the fuel pump flange, check if inlet, return and vent pipes are still fastened to the fuel reservoir.



Check the vent valve

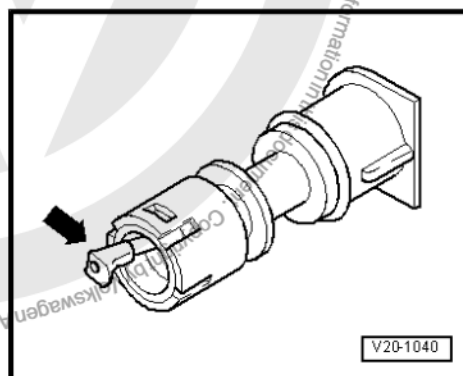
Lever in the resting position: closed.

Lever pushed in the arrow direction: open.



Note

Before vent valve installation, remove fuel reservoir lid.



1.2 Fuel filter - repair



1 - Supply tubes

- ☐ From the fuel tank.
- ☐ White or white-marked.
- ☐ Check that it is firmly fitted.

2 - Return hose

- ☐ Blue or blue-marked.
- ☐ Check that it is firmly fitted.

3 - Control valve

- ☐ Assembly position: the arrow should point to the fuel tank.
- ☐ When replacing the filter, remove the fastening clamp and remove the complete control valve with the fuel tubes.
- ☐ Below +15 °C: Passage to filter open.
- ☐ Above +31 °C: Passage to filter closed.

4 - Supply tubes

- ☐ For the auxiliary pump
⇒ [Item 15 \(page 13\)](#).
- ☐ Check that it is firmly fitted.
- ☐ White or white-marked.

5 - Return hose

- ☐ From the auxiliary pump
⇒ [Item 15 \(page 13\)](#).
- ☐ Check that it is firmly fitted.
- ☐ Blue or blue-marked.

6 - Fuel pipe

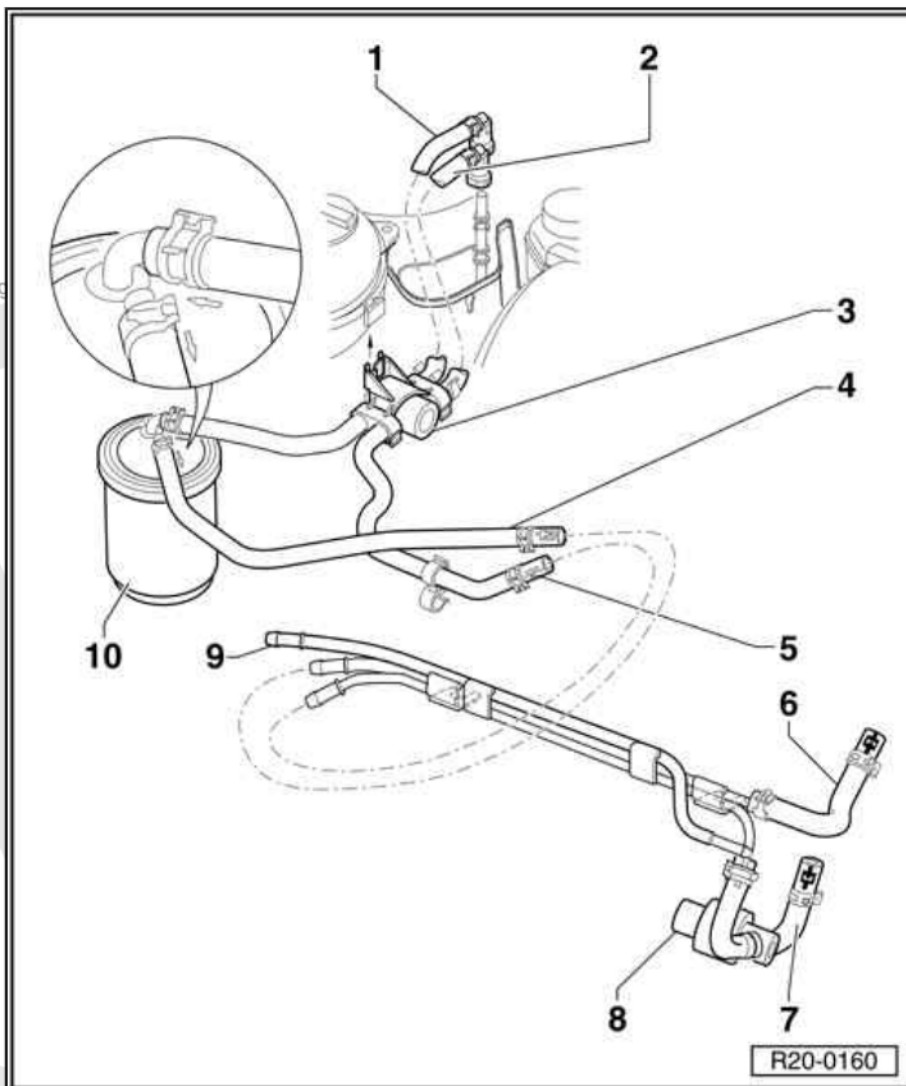
7 - Cooling system hose

8 - Fuel temperature sensor - G81-

9 - Cooling system hose

10 - Fuel filter

- ☐ Fuel with diesel before installing.
- ☐ The flow direction is indicated with an arrow.
- ☐ Do not exchange the connections.
- ☐ Replace if damaged.





1.3 Safety measures for working on fuel supply system



WARNING

Remember the following when performing assembly work, especially inside the engine compartment where there is little space:

- ◆ *All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling system and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.*
- ◆ *Allow easy access to all the moving or hot parts.*

While removing or installing the fuel level indicator sensor or fuel pump, when the fuel reservoir is full or partially full, observe the following:

When removing or installing the fuel gauge sensor or the fuel pump on the full or partially full tank, the following must be observed:



WARNING

- ◆ *The fuel and the fuel hoses in the fuel system may become very hot (burn danger)!*
- ◆ *Fuel system is under pressure!*
- ◆ *Wear protection glasses and gloves to perform any kind of repairs in the fuel system!*

- ◆ Before starting installation work, place a suction hose of a gas extraction device (on) near the fuel tank opening in order to absorb gases released by the fuel. If an extracting device is unavailable, use a radial fan (the engine must be out of air flow) with rate of air displacement greater than 15 m³/ hour.
- ◆ Avoid skin contact with fuel! Wear fuel resistant gloves!

1.4 Cleaning rules

For cleaning, carefully observe these "6 rules" when working on the fuel supply/injection system:

- ◆ Thoroughly clean all the connections and the surrounding areas before disconnecting them.
- ◆ Place removed parts on a clean surface and cover them. Use lint-free cloths!
- ◆ If the repair work will not be performed immediately, exposed components must be covered or carefully preserved.
- ◆ Install clean components only. Remove spare parts from packaging just prior to installation. Do not install components that have been stored outside of packaging (i.e. inside a tool box, etc.).
- ◆ With system open: Avoid using compressed air, if possible. Do not move vehicle, if possible.
- ◆ Also, make sure the diesel does not drain on the cooling system hoses. Hoses that have been in contact with the fuel should be cleaned immediately. The damaged hoses should be replaced.



1.5 Fuel reservoir - remove and install

Special tools and workshop equipment required

- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-

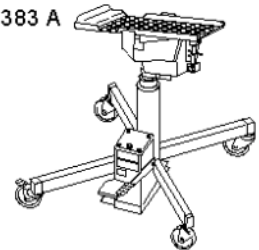
V.A.G 1331



W00-0427

- ◆ Gearbox or engine/gearbox jack - VAG 1383A-

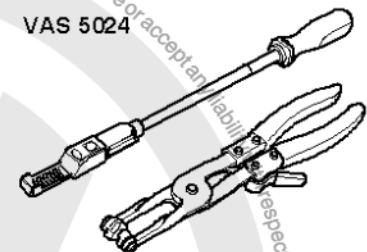
V.A.G 1383 A



W00-0120

- ◆ Spring-type clip pliers - VAS 5024-

VAS 5024



W00-0495

- ◆ Fuel extractor - VAS 5190-

1.5.1 Removal

- Take safety precautions before starting work ➤ [page 92](#) .
- Follow cleaning rules ➤ [page 92](#) .
- Check if the vehicle has code radio; if so, request respective anti-theft code.
- With ignition off, disconnect earth strap from the battery.
- Tilt the back seat forwards.
- Remove the lid which gives access to the fuel pump.



WARNING

- ◆ *The fuel and the fuel hoses in the fuel system may become very hot (burn danger)!*
- ◆ *Fuel system is under pressure!*
- ◆ *Wear protection glasses and gloves to perform any kind of repairs in the fuel system!*

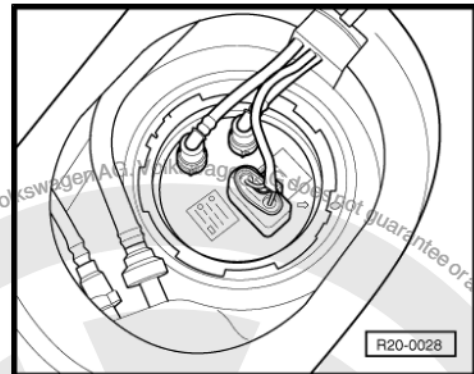
- Drain the fuel tank.
- Disconnect the return -1- and supply lines -2- as well as the connector -3- of the fuel pump.



Note

Press the locks on the tubes connectors to disconnect them.

- Lower the exhaust system a little, and fasten it with a metal wire.
- Remove the heat deflector between the exhaust and the fuel tank.
- Remove the fastening clamps of the supply line using the Standart clamp pliers - VAS 5024A- .
- Support the fuel tank using the Gearbox or engine + gearbox assembly jack - VAG 1383A- .
- Remove fastening screws from the fuel tank.
- Lower the fuel tank.



1.5.2 Installation

Installation is carried out by in reverse order of the removal sequence, whilst observing the following:

- ◆ The vent and fuel hoses should be installed free of folds.
- ◆ Check that the fuel hoses are firmly connected.
- ◆ Do not invert the fuel and return lines (blue return line, or with blue marking, black supply hose).



Note

After installing the fuel gauge sensor, check that the supply, return and vent lines are still attached to fuel tank.



The flange mark should be aligned with the fuel tank mark -arrow-.

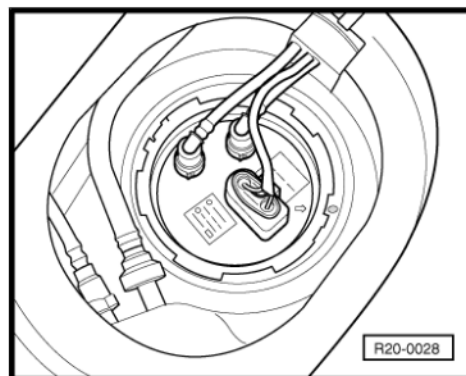
Blue or blue marked return line -1- connected to the joint identified with an -R-.

Black supply line -2- connected to the connection identified with a -V-.



Note

After installing the fuel pump flange, check if inlet, return and vent pipes are still fastened to the fuel reservoir.

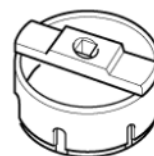


1.6 Fuel pump - remove and install

Special tools and workshop equipment required

- ◆ Wrench - VW 5321/9- or Wrench - T10334-

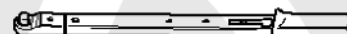
VW 5321/9



Q00-0016

- ◆ Torque Wrench - 40 to 200 Nm (1/2" drive) - VAG 1332-

V.A.G 1332



W00-0428

1.6.1 Removal

Follow safety measures ⇒ [page 92](#)

Follow cleaning rules ⇒ [page 92](#) .

- Check if the vehicle has code radio, if so, request respective anti-theft code.
- With ignition off, disconnect earth wire from battery.
- Tilt the back seat forwards.
- Remove the lid which gives access to the fuel pump.



- Disconnect the return -1- and supply lines -2- as well as the connector -3- of the fuel pump.



Note

Press the locks on the tubes connectors to disconnect them.



WARNING

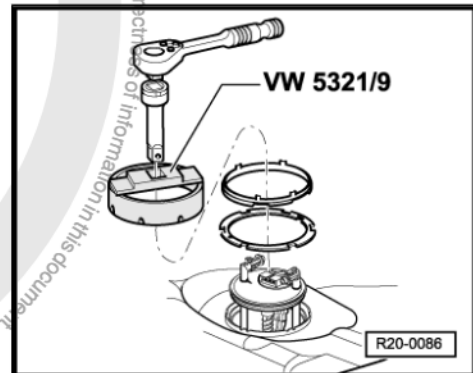
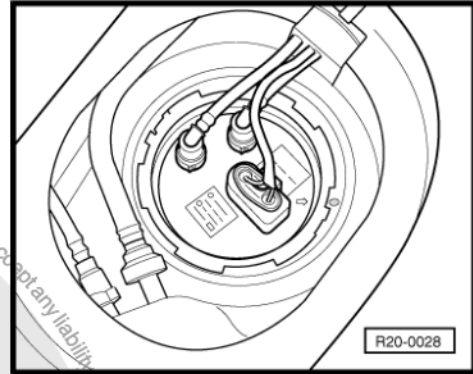
- ◆ The fuel and the fuel hoses in the fuel system may become very hot (burn danger)!
- ◆ Fuel system is under pressure!
- ◆ Wear protection glasses and gloves to perform any kind of repairs in the fuel system!

- Loosen the pump with a Wrench - VW 5321/9 - or Wrench - T10334- .
- Remove the fuel pump and seal the opening in the fuel tank.



Note

If the fuel pump is replaced, drain it before discarding it.



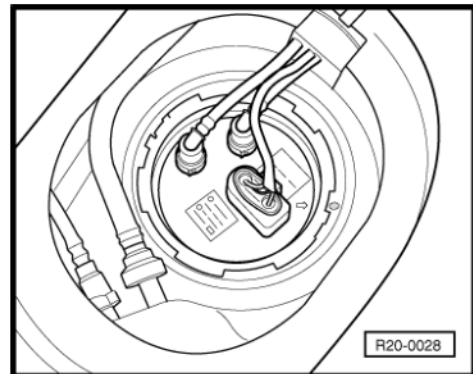
1.6.2 Installation

Installation is carried out by in reverse order of the removal sequence, whilst observing the following:



Note

- ◆ Do not fold the fuel level indicator sensor when installing.
- ◆ Insert the flange seal or the dry fuel pump in the fuel tank opening.
- ◆ Moisten the seal with fuel only when installing the flange or the fuel pump.
- ◆ Make sure the fuel pipelines are firmly seated.
- ◆ After installing the fuel pump flange, check that the supply, return and vent lines are still attached to fuel tank.
- ◆ The flange mark should be aligned with the fuel tank mark -arrow-.



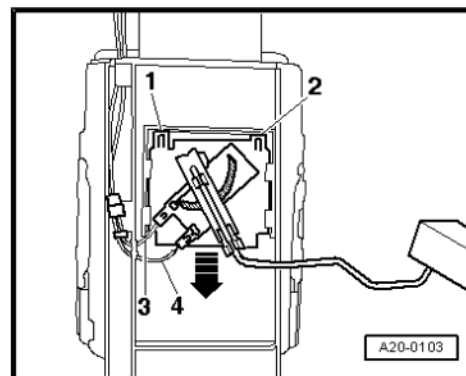
1.7 Fuel gauge sensor - remove and install

1.7.1 Removal

- Remove fuel pump ⇒ [page 95](#) .



- Release and remove the wire terminals -3- and -4-.
- Raise the retention locks -1- and -2- with a screwdriver and pull the fuel level sensor outwards and downwards -arrow-.



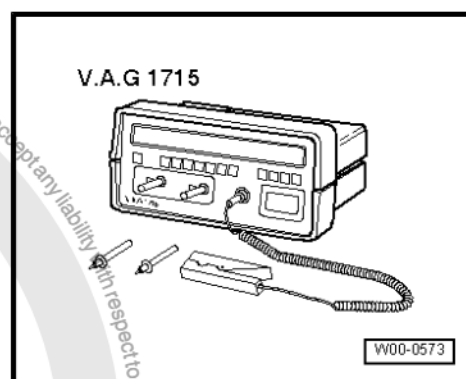
1.7.2 Installation

- Insert the fuel level sensor onto the fuel pump guides and press up until fitting.

1.8 Fuel pump - check

Special tools and workshop equipment required

- ◆ Portable multimeter - VAG 1526C- or Multimeter - V.A.G 1715-



- ◆ Auxiliary cable set - V.A.G 1594 A-
- ◆ Test probe - VAG 1527B-

Test conditions

- Fuses should be in good condition.
- The Battery voltage must be at least 11.5 V.
- All power consuming devices, like lights and rear window heater, must be off.

Check supply function and voltage

- Tilt the back seat forwards.
- Remove the lid which gives access to the fuel pump.
- Activate the starter for some time. The operation of the fuel pump should be heard.
- Turn the ignition off.

If the fuel pump does not work:

- Remove the 4-pin connector from the fuel pump flange.



- Connect the Test probe - VAG 1527B- to the connector external contacts using the adapter cables of the -V.A.G 1594 - .
- Turn the ignition on. The LED should turn on for about 2 seconds.

If the LED does not light up:

- Locate and eliminate cable interruption, according to the current loop diagram. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If the LED lights up (correct power supply).

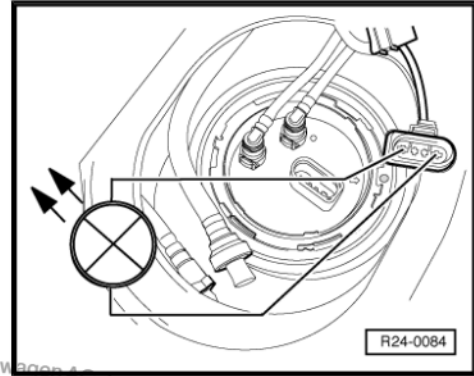
- Remove fuel pump ⇒ [page 95](#) .
- Check that the cables between the flange and the fuel pump are connected.

If there is no cable interruption:

- Replace fuel pump ⇒ [page 95](#) .

Check the fuel pump current draw

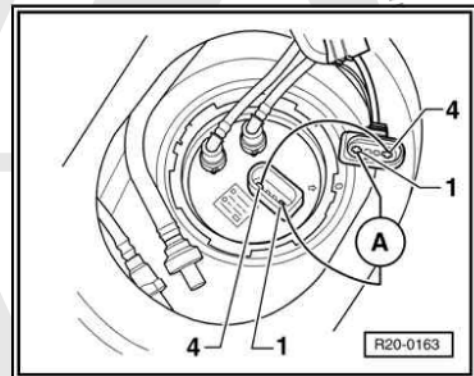
- Remove the 4-pin connector from the fuel pump flange.
- Adjust the multimeter reading scale to 20 A and, using the auxiliary cables of the -V.A.G 1594 A- , turn on the multimeter in series between the contacts -1- of the fuel pump connector.



Note

The test probe of the Multimeter - V.A.G 1715 - can also be placed between the connector contact -1- and the fuel pump, using adapter cables of the Multimeter - V.A.G 1715 - .

- Turn on the contacts -4- of the fuel pump connector using the adapter cables of the -V.A.G 1594 A- .
- Start the engine and keep it idling.
- Measure the fuel pump current. Specified value: Mín. 6.3 A and Max. 7.8 A.
- If the values measured are not the specified:
- Replace fuel pump ⇒ [page 95](#) .



1.9 Accelerator mechanism - repair



1 - Mounting bracket

- ☐ Remove and install: ⇒
Braking system; Rep.
gr. 46 ; Brakes - Me-
chanical systems .

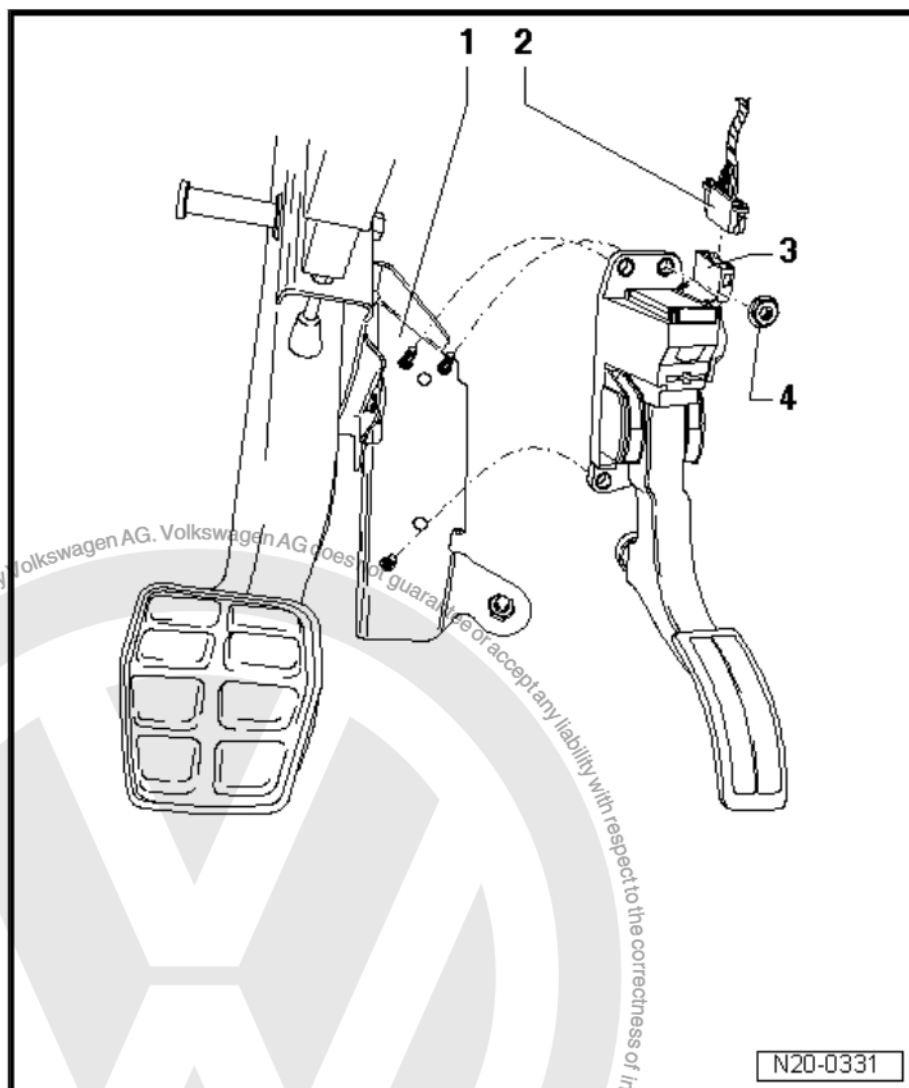
2 - Connector

- ☐ Black, 6 pins.

3 - Accelerator pedal position
sensor - G79-

- ☐ Non-adjustable.
- ☐ The accelerator pedal
position sensor sends
the pedal position to the
engine command unit.
- ☐ Remove the feet area
cover to remove sensor.

4 - 10 Nm

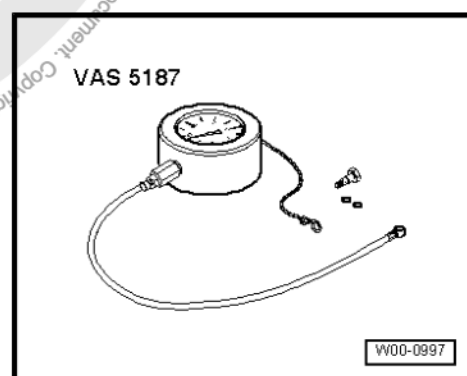


N20-0331

1.10 Auxiliary pump - check

Special tools and workshop equipment required

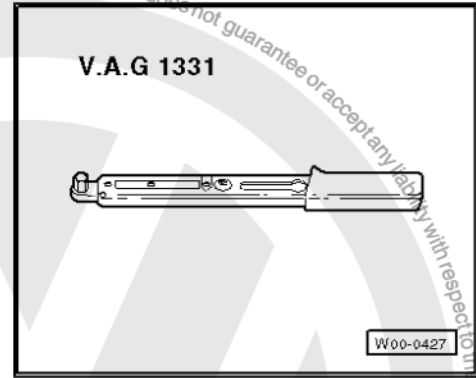
- ◆ Pressure test device - VAS 5187-



W00-0997



- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331



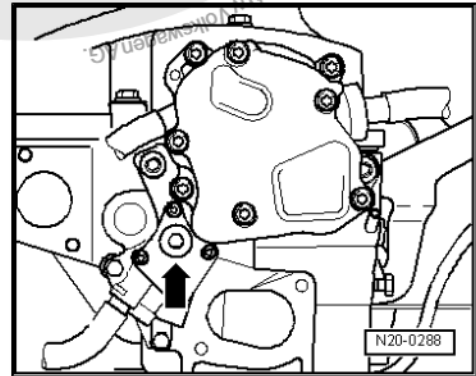
- ◆ Vehicle Diagnosis, Measurement and Information System - VAS 5051A/52- with cable Diagnostic cable (3 m) - VAS 5051/5-

Test conditions



- Coolant temperature of at least 85 °C.
- Injectors must be in accordance.
- Fuel tubes and filter should not be obstructed.
- The retention valve in the fuel supply hose must be in accordance.

Test sequence

- Remove the plug-arrow-





- Connect the Auxiliary pump test device - VAS 5187- as shown.
- Start the engine and keep it idling.
- Connect the Vehicle diagnostic, testing and information system - VAS 5051A/52- and select the operation mode Vehicle self-diagnosis. Select the electronic command unit of the engine with the 01 Engine electronic system.
- Select the function 08 Read value block.
- Select the screen "2" via keypad (on the keyboard) and confirm with key .
- Read the idle speed in field 1.
- Increase the engine speed up until 1500 rpm.
- Observe the pressure gauge pressure. Specified value: min. 3.5 bar.
- Press key .
- Select function 06 Conclude test.
- Turn the ignition off.

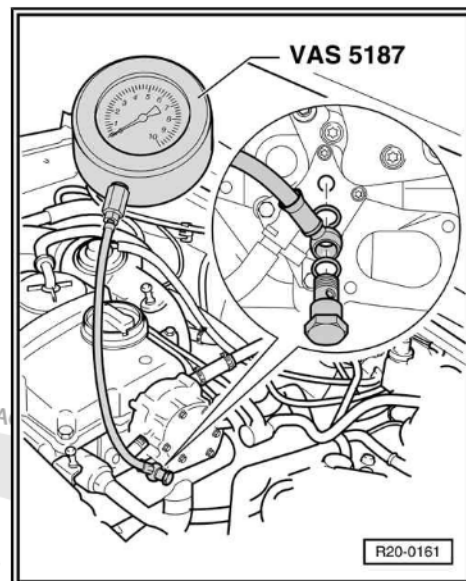
If the specified value is not obtained:

- Replace the auxiliary pump ⇒ [page 101](#).



Note

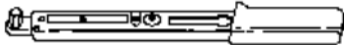
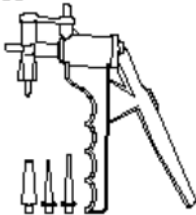

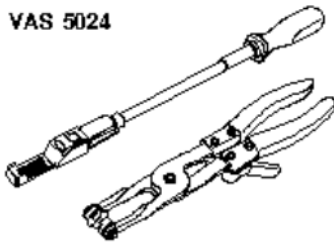
After removing the pressure test device, press the plug with 25 Nm. Always replace the seal.



1.11 Auxiliary pump - remove and install



Special tools and workshop
equipment required

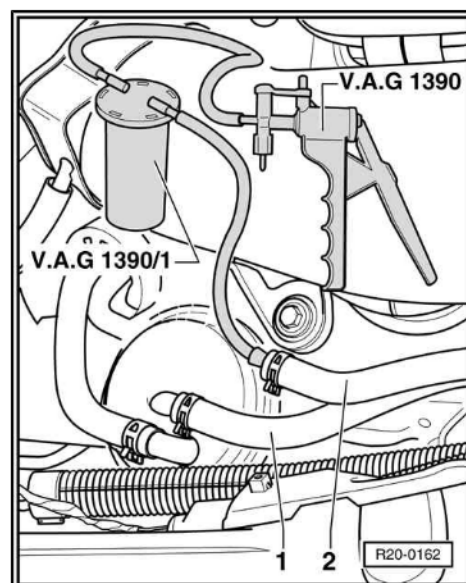
V.A.G 1331 	V.A.G 1390 
V.A.G 1390/1 	VAS 5024 
<div>W20-0054</div>	

- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-
- ◆ Vacuum pump - VAG 1390-
- ◆ Fluid recipient - V.A.G 1390/1-
- ◆ Spring-type clip pliers - VAS 5024A-

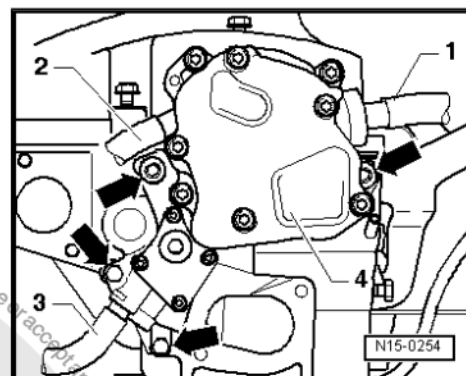


1.11.1 Removal

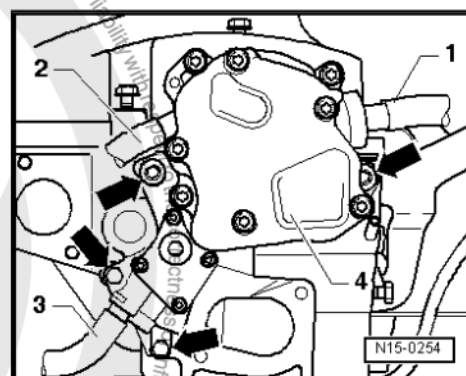
- Remove the supply line -1- (white mark) and the return line -2- (blue mark) of the fuel filter.
- Connect the vacuum pump - VAG 1390- with the Fluid container - VAG 1390/1- to the return hose.
- Activate the Vacuum pump - VAG 1390- until the fuel stops coming out of return lining. Take care in order to not suck fuel to the inside of the vacuum pump.



- Remove the vacuum pump -1- belonging to the auxiliary pump booster -4-.
- Remove supply lining -2- (white mark) of the auxiliary pump -4-.
- Remove the mounting bolts -arrows-.
- Remove the auxiliary pump -4- out of the cylinder head.



- Pull the auxiliary pump -4- slightly up and remove the return lining -3- (blue mark).



1.11.2 Installation

Installation is carried out by in reverse order of the removal sequence, whilst observing the following:

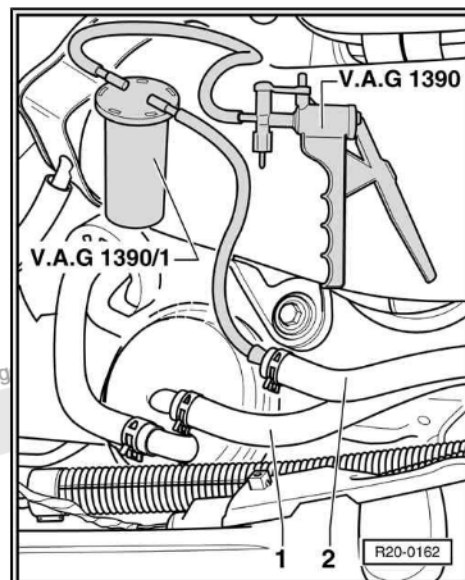


Note

- ◆ Ensure the correct seating of the auxiliary pump coupling on the camshaft.
- ◆ Always replace the auxiliary pump seals.



- Fit the return lining -3- (blue mark) on the auxiliary pump return connection.
- Install the auxiliary pump and tighten the upper fastening screws with 20 Nm.
- Tighten the lower fastening screws with 10 Nm.
- Fit the supply lining -2- (white mark) at the auxiliary pump supply connection and vacuum hose -1- of the auxiliary pump booster -4-.
- Connect the lining -1- (white mark) to the fuel filter.
- Connect the vacuum pump - VAG 1390- with the Fluid container - VAG 1390/1- to the return hose.
- Activate the Vacuum pump - VAG 1390- until the fuel stops coming out of return lining. Take care in order to not suck fuel to the inside of the vacuum pump.
- Fit the return lining -2- (blue mark) in the fuel filter.





21 – Turbocharging/supercharging

1 Supercharging system with turbo-charger

1.1 Safety measures



WARNING

Remember the following when performing assembly work, especially inside the engine compartment where there is little space:

- ◆ *All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling system and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.*
- ◆ *Allow easy access to all the moving or hot parts.*

If during a test drive it is necessary to use test and measuring equipment, observe the following:

- ◆ Always install test and measuring equipment on the back seat and have them operated by a second person.

If test and measuring equipment are operated from the passenger seat, the person seated there may be injured should the airbag activate in case of accident.

1.2 Rules for cleaning

For the works in the supercharging system, carefully observe the following cleaning rules:

- ◆ Thoroughly clean all the connections and the surrounding areas before disconnecting them.
- ◆ Place removed parts on a clean surface and cover them. Use lint-free cloths!
- ◆ If the repair work will not be performed immediately, exposed components must be covered or carefully preserved.
- ◆ Install clean components only. Remove spare parts from packaging just prior to installation. Do not install components that have been stored outside of packaging (i.e. inside a tool box, etc.).
- ◆ During repair services, remove the oil from the hoses connections and ends.
- ◆ With system open: Avoid using compressed air, if possible. Do not move vehicle, if possible.

1.3 Turbocharger remove and install

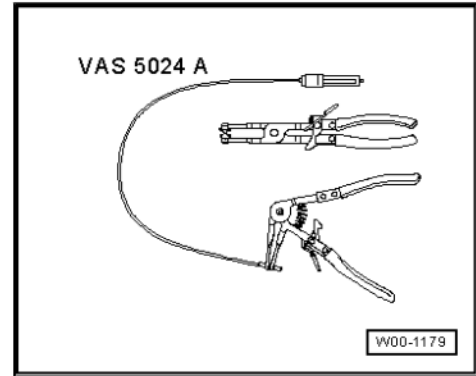
Follow safety measures ⇒ [page 105](#).

Follow cleaning rules ⇒ [page 105](#).



Note

- ◆ All hoses are clamped or coupled.
- ◆ When installing spring clamps, use Standart clamp pliers - VAS 5024A-.
- ◆ Do not install the hoses containing lubricant oil in the connections.
- ◆ The supercharging system should be free of leakage.
- ◆ Before installing the oil supply line, fill the turbocharger through the connection point with engine oil.
- ◆ After installing the turbocharger, run the engine in idle for around 1 minute. Do not accelerate the engine. This will guarantee that the turbocharger is adequately lubricated.
- ◆ Always renew self-locking nuts.



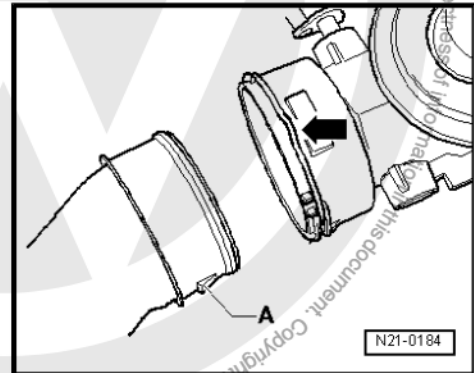
Hoses with coupling connections.



Note

All hoses in the supercharging system are clamped with spring clamps or connections. Always check the following points on the connections:

- Release the connection pulling the fastening clamp -arrow-, without using tools.
- When assembling, make sure the retention latches -A- are firmly fixed.





1 - Exhaust manifold

- ☐ With exhaust gases turbocharger.
- ☐ Replace only completely.
- ☐ To remove, first remove the hose between the air mass turbocharger/gauge, intake manifold/intercooler hose, intake flange with exhaust gas recirculation and intake manifold valve motor, as well as the drive shaft right cover.

2 - Intake manifold

3 - From the intercooler

4 - Gasket

- ☐ Renew.
- ☐ Overlap (thread) towards the intake manifold.

5 - 25 Nm

6 - Gasket

- ☐ Check installation position.

7 - From the air filter

8 - Mounting bracket

- ☐ From the heat deflector.

9 - Washer

10 - 25 Nm

11 - Heat deflector

- ☐ Fix on the support ⇒ [Item 8 \(page 107\)](#).

12 - Hollow screw, 15 Nm

13 - Seal

- ☐ Renew.

14 - Hose

- ☐ For Electromagnetic valve for load pressure limitation - N75-.

15 - Oil return line, 30 Nm

- ☐ For the engine block.

16 - 15 Nm

17 - Gasket

- ☐ Renew.

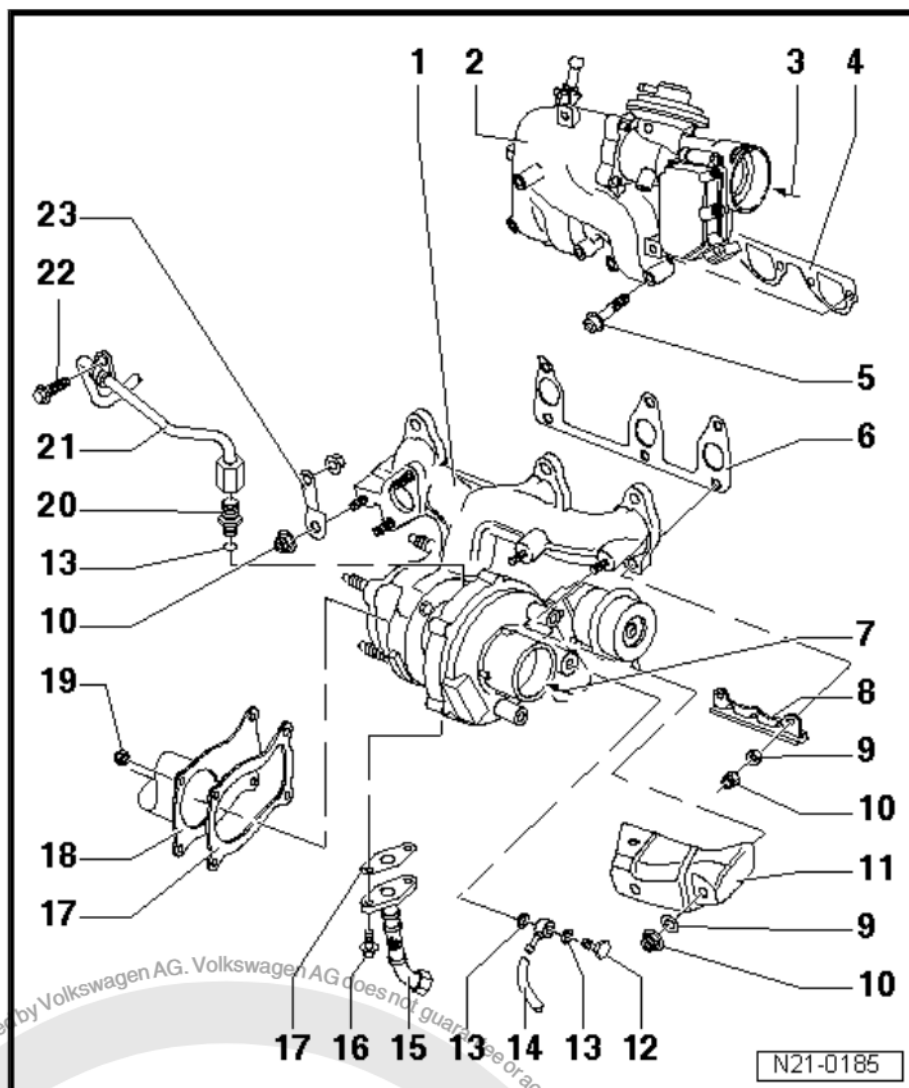
18 - Front exhaust pipe

19 - 25 Nm

- ☐ Renew.

20 - Connection, 30 Nm

- ☐ Renew.
- ☐ Apply -G 052 112 A3- on the threads and contact surface of the screw.
- ☐ Fill the turbocharger with engine oil before installing the oil supply line.





21 - Oil supply line

- ☐ From the oil filter.
- ☐ Before installing, check the continuity of the oil supply line.
- ☐ Before installing, fill the turbocharger with engine oil through the oil supply line.
- ☐ Remove and install ➔ [page 68](#) .

22 - 10 Nm

23 - Mounting bracket

1.4 Intake air cooling system components (intercooler) - remove and install

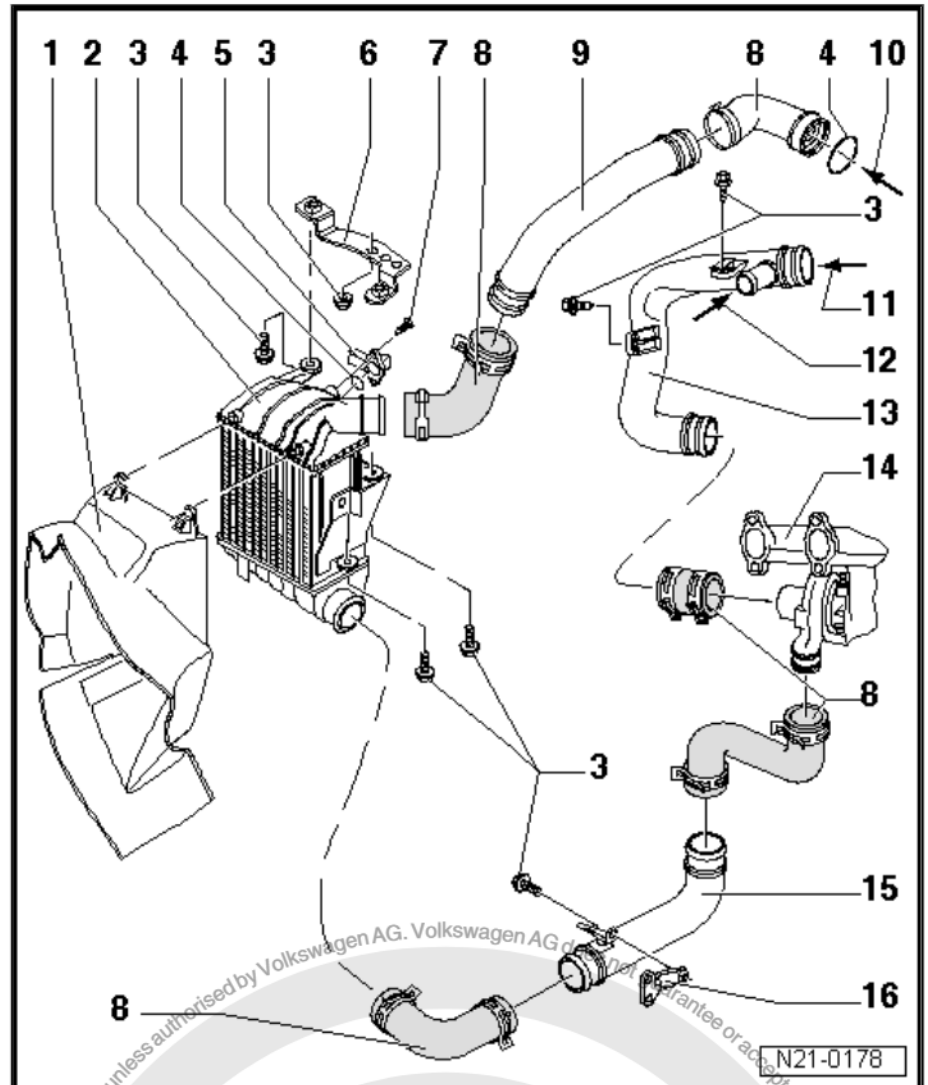


Note

- ◆ *All hoses are fixed by clamps.*
- ◆ *If necessary, use a sliding agent (water without additive). Do not use sliding agents which contain oil.*
- ◆ *When repairing, remove the oil from the hose connections and ends.*
- ◆ *The supercharging system should be free of leakage.*



- 1 - Air ducts
- 2 - Intercooler
- 3 - 8 Nm
- 4 - Seal
 - ☐ Replace if damaged.
- 5 - Intake manifold pressure sensor - G71- with Air intake temperature sensor - G72-
- 6 - Mounting bracket
- 7 - 5 Nm
- 8 - Hose
- 9 - Tube
- 10 - From the valve for recirculation of exhaust gases
- 11 - From the air filter
- 12 - From the cylinder head cover
- 13 - Tube
- 14 - Exhaust manifold
- 15 - Tube
- 16 - Mounting bracket
 - ☐ From the tube.
 - ☐ Fixed to the crankcase.





23 – Mixture preparation - injection

1 Direct injection Diesel system maintenance

The diesel direct injection system control unit is equipped with a fault memory. Before carrying out repairs, and for troubleshooting, refer to the event memory ⇒ [page 119](#).

Safety measures ⇒ [page 111](#).

Cleaning rules ⇒ [page 112](#).

1.1 Installation locations - overview

Components A to D are not represented in the illustration.

A - Brake pedal switch - F47-
or Brake light switch - F-

- ☐ Together in one case, in the feet compartment, on the brake pedal.

B - Accelerator pedal position sensor - G79- and Sensor 2 of accelerator pedal position - G185-

- ☐ At the feet compartment, on the accelerator pedal.

C - Clutch pedal switch - F36-

- ☐ In feet compartment, on clutch pedal.

D - Fuel pressure regulator

- ☐ In the fuel pump.

1 - Valve locking

- ☐ Vacuum hose connection diagram ⇒ [page 126](#).

2 - Exhaust gas recirculation valve (mechanic)

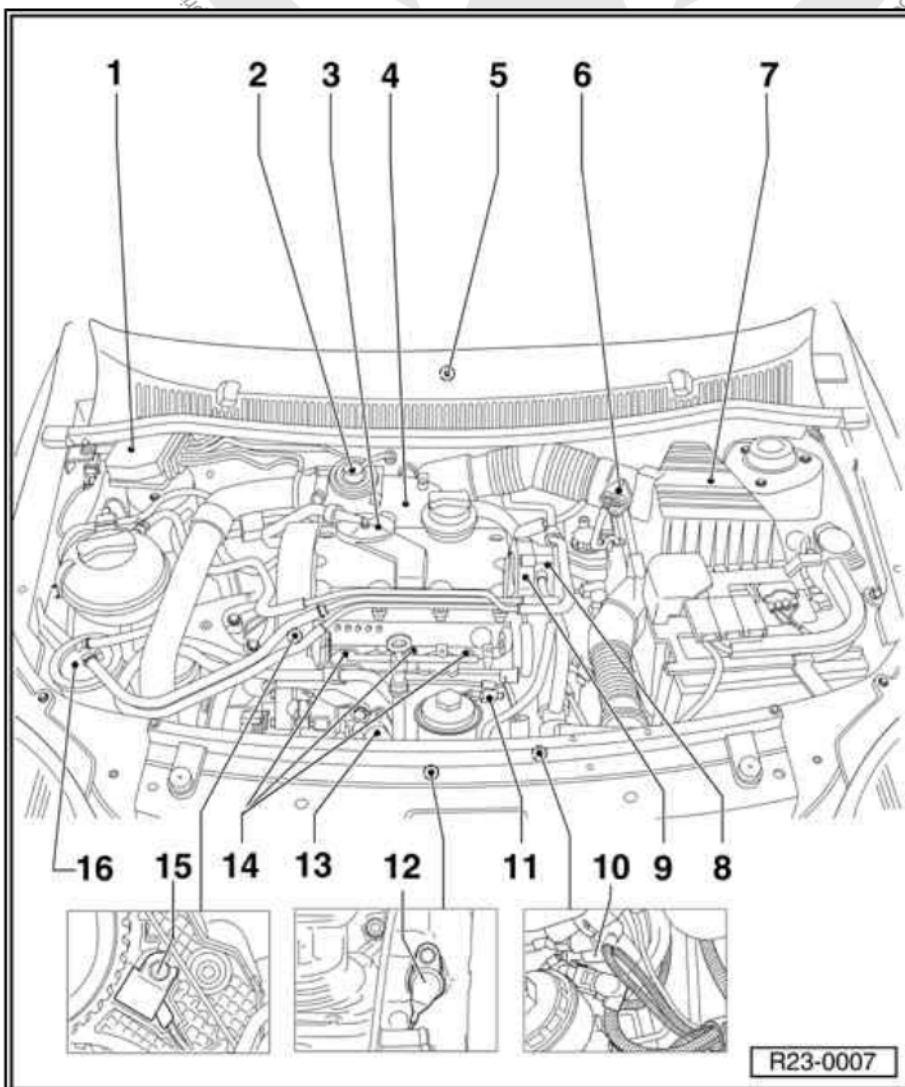
- ☐ With the intake manifold valve.

3 - Pressure regulating valve

- ☐ For the crankcase vent.

4 - Intake manifold

- ☐ Intake manifold pressure sensor - G71- with Air intake temperature





- sensor - G72- .
- 5 - Control unit of Diesel direct injection system - J248-
 - ☐ With Altitude sensor - F96- .
 - ☐ Replace ➔ [page 119](#) .
- 6 - Air mass gauge - G70-
- 7 - Air cleaner
- 8 - Auxiliary pump
 - ☐ Check ➔ [page 99](#) .
- 9 - Vacuum pump
- 10 - Connector
 - ☐ For the pump valve / 1 cylinder injector - N240- ... Pump valve / 4 cylinder injector - N243- .
- 11 - Fuel temperature sensor - G81-
- 12 - Engine speed sensor - G28-
- 13 - Thermostatic valve
- 14 - Glow plugs
- 15 - Hall Sender - G40-
 - ☐ To the camshaft position.
- 16 - Fuel filter

1.2 Safety measures



WARNING

Remember the following when performing assembly work, especially inside the engine compartment where there is little space:

- ◆ *All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling system and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.*
- ◆ *Allow easy access to all the moving or hot parts.*

If during a test drive it is necessary to use test and measuring equipment, observe the following:

- ◆ Always install test and measuring equipment on the back seat and have them operated by a second person.

If test and measuring equipment are operated from the passenger seat, the person seated there may be injured should the airbag activate in case of accident.

To avoid personal injuries and/or damage to the injection and glow plug system, observe the following:

- ◆ The ignition should be turned off before turning on or off the test cables of the injection and glow plugs system.
- ◆ In case you want the engine to turn with the starting speed but without coming into operation, in order to check the compression, for example, disconnect the connector from the cylinder head injector.
- ◆ Before disconnecting the battery, check whether the vehicle has a coded radio. If so, request the anti-theft code.



- ◆ Disconnect and turn on the battery only with the ignition off, otherwise the diesel direct injection system command unit can be damaged.

1.3 Cleaning rules

When working in the fuel supply/injection system, pay attention to the following cleaning rules:

- ◆ Thoroughly clean all the connections and the surrounding areas before disconnecting them.
- ◆ Place removed parts on a clean surface and cover them. Use lint-free cloths!
- ◆ If the repair work will not be performed immediately, exposed components must be covered or carefully preserved.
- ◆ Install clean components only. Remove spare parts from packaging just prior to installation. Do not install components that have been stored outside of packaging (i.e. inside a tool box, etc.).
- ◆ With system open: Avoid using compressed air, if possible. Do not move vehicle, if possible.
- ◆ Also, make sure the diesel does not drain on the cooling system hoses. Hoses that have been in contact with the fuel should be cleaned immediately. The damaged hoses should be replaced.

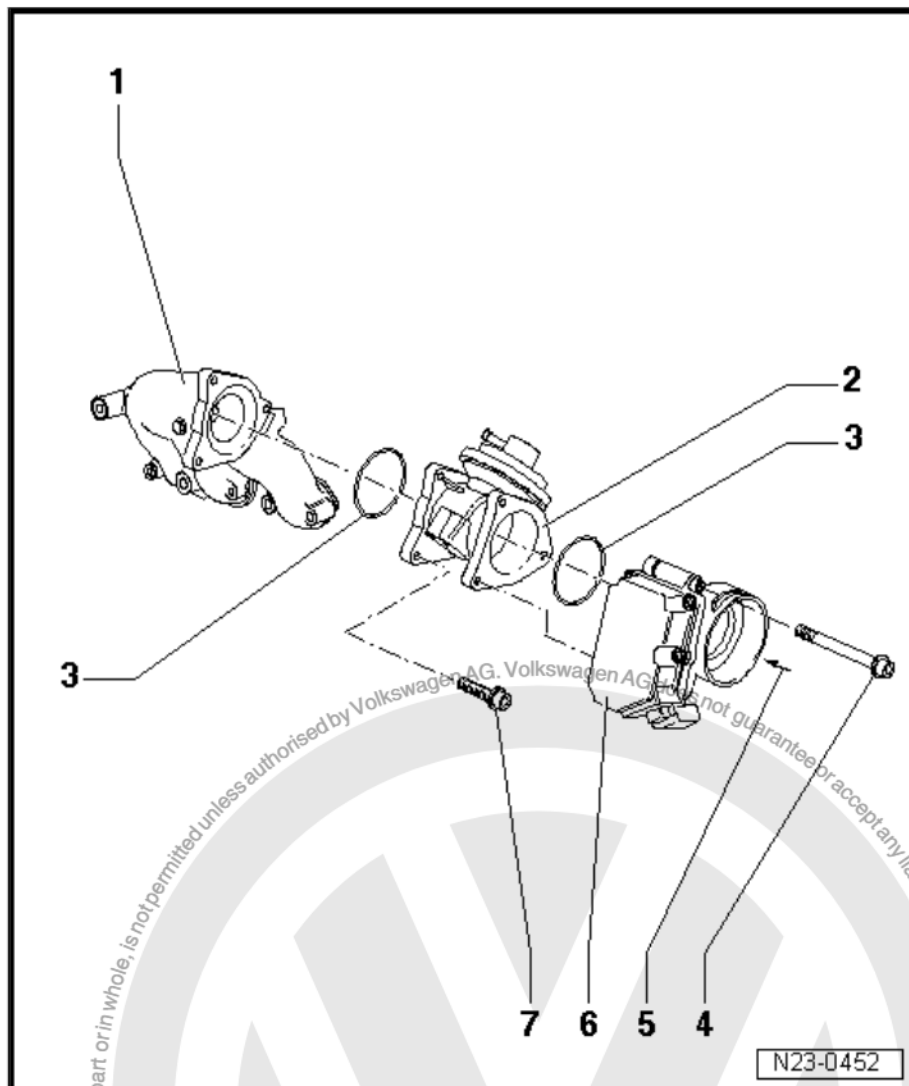
1.4 Intake manifold valve - repair

The intake manifold valve closes for about 3 seconds when turning the engine off, opening again. This reduces the stop bump.





- 1 - Intake manifold
- 2 - Intake connection flange
 - ☐ With the valve for recirculation of exhaust gases.
- 3 - Seal
 - ☐ Renew.
- 4 - 10 Nm
- 5 - From the intercooler
- 6 - Intake manifold valve motor - V157-
- 7 - 10 Nm



1.5 Injectors - repair

- ◆ Follow cleaning rules ⇒ [page 92](#) .
- ◆ Always replace the retainers and seal rings.

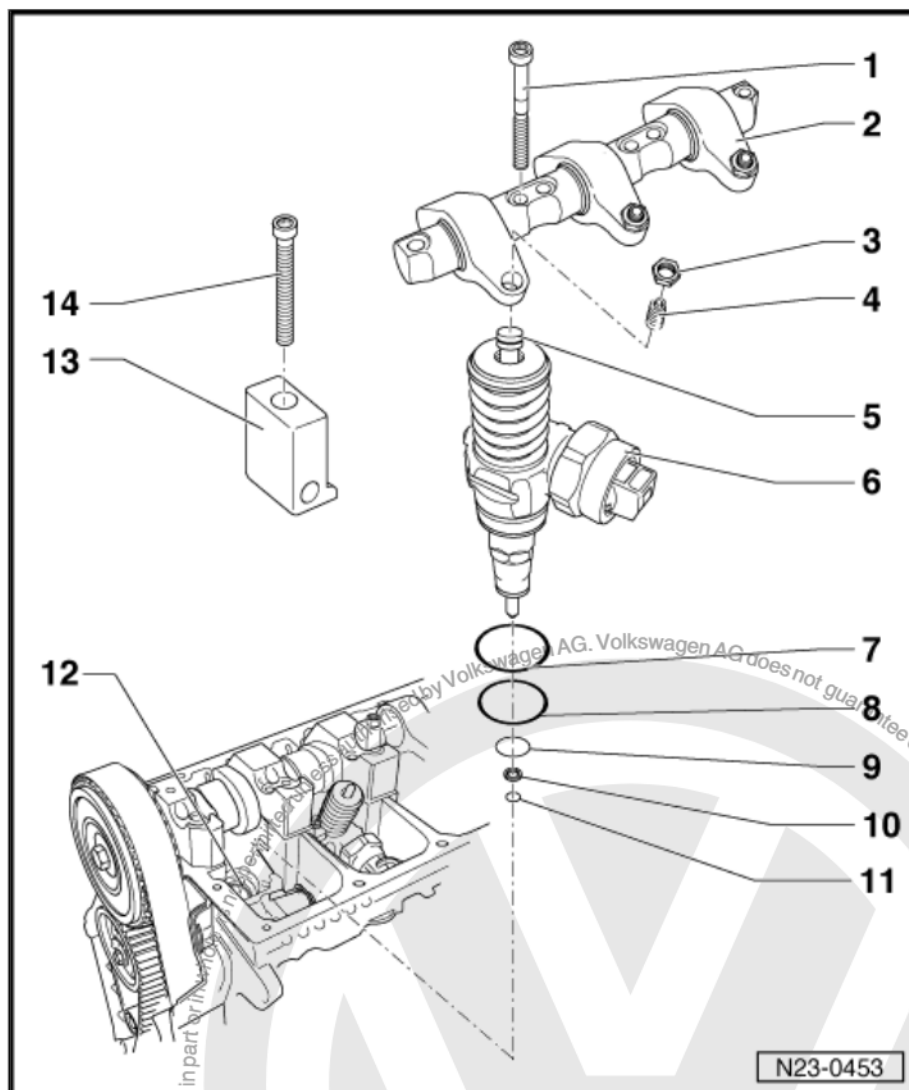


WARNING

Always replace self-locking nuts and bolts subject to angular torque



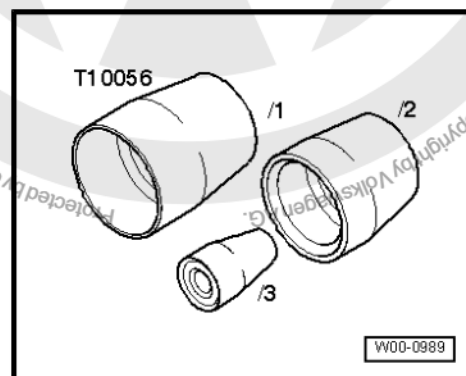
- 1 - 20 Nm + 90°
☐ Renew after each re-
moval.
- 2 - Swinging arm shaft
☐ With swinging arm.
☐ Remove and install
⇒ [page 115](#) .
- 3 - Shear nut
- 4 - Regulating bolt
☐ Renew.
- 5 - Ball pin
☐ Renew.
- 6 - Injectors
☐ Remove and install
⇒ [page 115](#) .
- 7 - Seal
☐ Replace ⇒ [page 114](#) .
- 8 - Seal
☐ Replace ⇒ [page 114](#) .
- 9 - Seal
☐ Replace ⇒ [page 114](#) .
- 10 - Thermal insulation sealing
☐ Renew.
- 11 - Retaining ring
- 12 - Cylinder head
- 13 - Tensor block
- 14 - 12 Nm + 270°
☐ Renew after each re-
moval.



1.6 Injectors seal ring - remove and install

Special tools and workshop equipment required

- ◆ Assembly sleeve - T10056-



1.6.1 Removal

- Carefully remove the old rings from the injector.



- Check that no burr has been formed in the ring seat in the operation above.

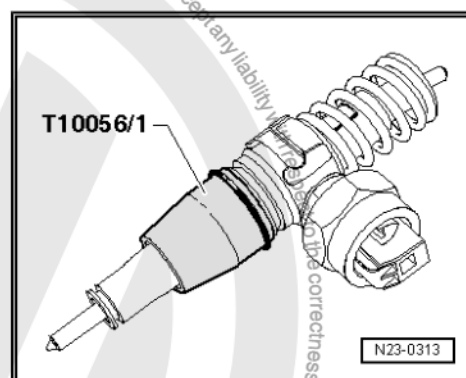
1.6.2 Installation



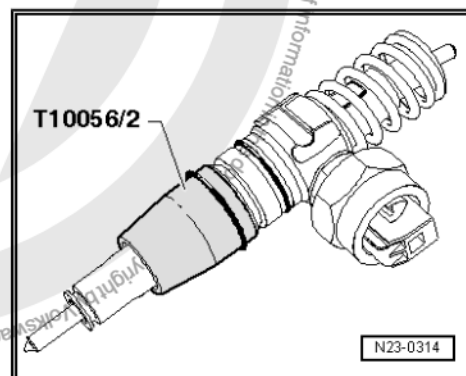
Note

- ◆ *Always use assembly sleeves to seat the rings. If the assembly sleeves are not used, the rings can be damaged.*
- ◆ *Gradually introduce the rings without colored marks. Check, therefore, that the rings are correctly positioned in their grooves. The ring size decreases towards the nozzle.*
- ◆ *Prevent the rings from rolling when slide them. The rings can be twisted when seated in the injector.*

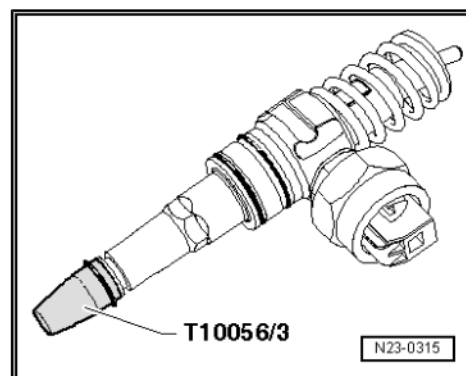
- Pull the thermal insulation cap together with the fastening clamp.
- Carefully clean the seating surfaces of the injector ring.
- Install the Assembly sleeve - T10056/1- until the stop in the injector.
- Carefully slide the upper ring on the assembly sleeve until its housing in the injector.
- Remove the assembly sleeve.



- Install the Assembly sleeve - T10056/2- until the stop in the injector.
- Carefully slide the central ring on the assembly sleeve until its housing in the injector.
- Remove the assembly sleeve.



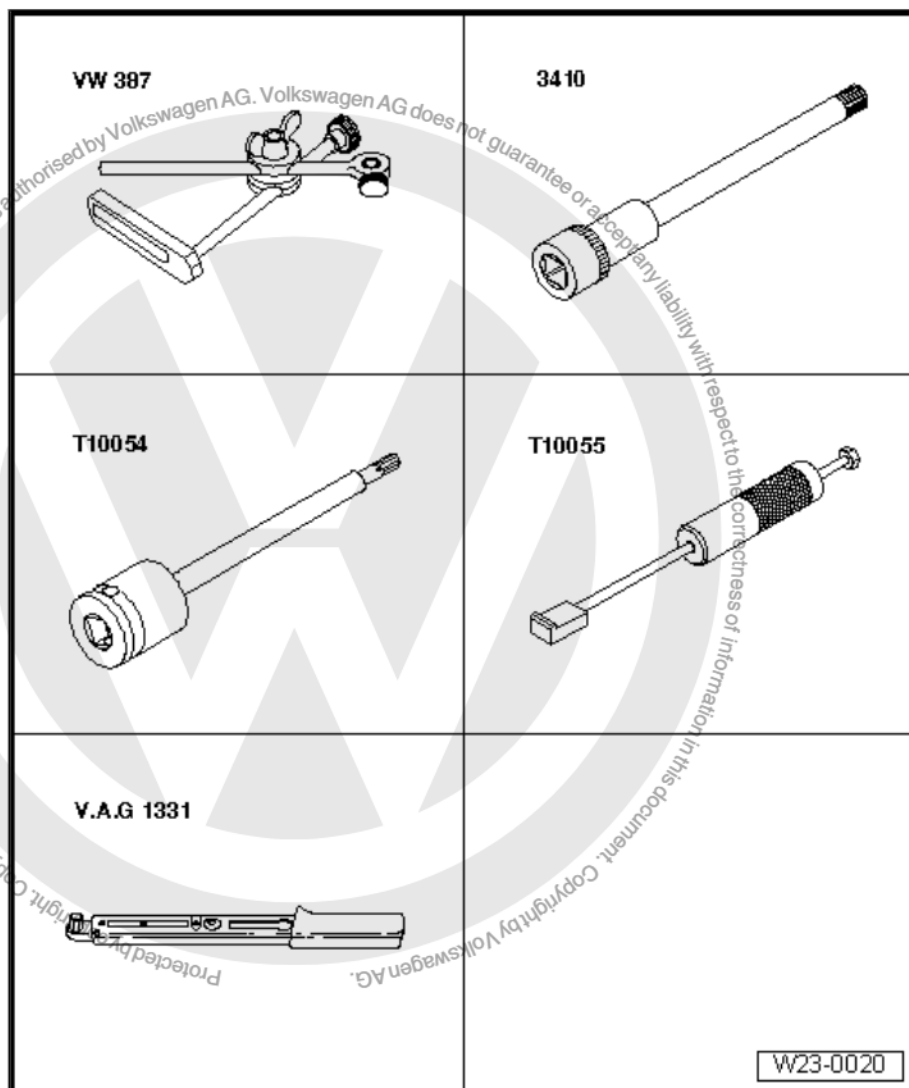
- Install the Assembly sleeve - T10056/3- until the stop in the injector.
- Carefully slide the lower ring on the assembly sleeve until its housing in the injector.
- Remove the assembly sleeve.
- Install the thermal insulation cap together with the fastening clamp.



1.7 Nozzles - remove and install



Special tools and workshop
equipment required



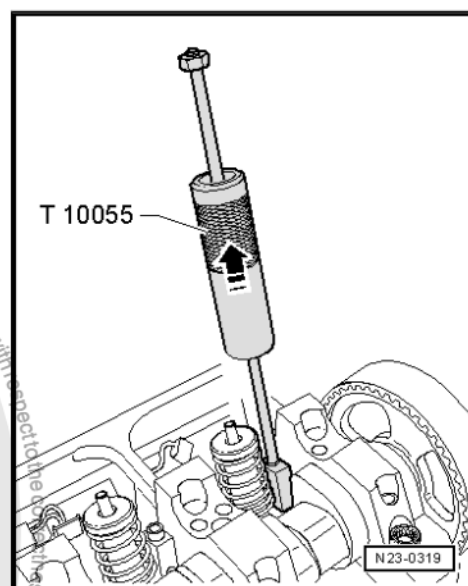
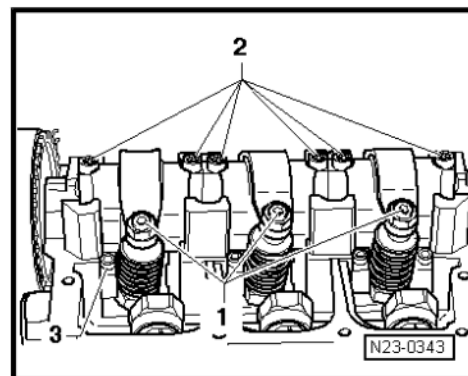
- ◆ Mounting bracket - VW 387-
- ◆ Multi-teeth socket - 3410-
- ◆ Special wrench, long range - T10054-
- ◆ Puller - T10055-
- ◆ Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331-

1.7.1 Removal

- Remove the upper mechanical distribution cover and cylinder head cover.
- Turn the crankshaft until the injector cams to be removed point up.



- Release the shear nuts of the adjustment bolts -1- and remove the screws.
- Remove the Swinging arm fastening screws -2- (from the outside to the inside) with the Multi-toothed socket - 3410- and remove the swinging arm shaft.
- Remove the fastening screws from the tensor block -3- with the Special wrench, long range - T10054- and remove the block.
- Remove the injector connector using a screwdriver. To prevent inclination, support the opposite side of the connector with slight finger pressure.
- Observe the injectors localization.
- Position the Puller - T10055- in the groove beside the injector instead of the tensor block.
- Pull the injector to the outside of the cylinder head with light blows.



1.7.2 Installation



Note

- ◆ *Every time a repair is done and it is necessary to adjust the injector, the adjustment bolt in the swinging arm and also the ball pin of the injector need to be replaced.*
- ◆ *The new injectors are provided with rings and thermal insulation cap.*
- The thermal insulation cap and the rings need to be replaced if the old injector is used again ⇒ [page 114](#)
- Check if the three rings and the thermal insulation cap together with the fastening clamp are correctly seated before installing the injector.



Note

The rings cannot be twisted.

- Lubricate the rings and carefully seat the injector inside the cylinder head.
- Uniformly push the injector to the inside of the cylinder head until its stop.



- Fix the tensor block inside the groove beside the injector.



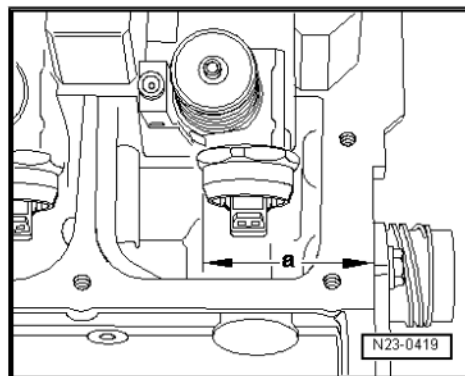
Note

If the injector is not in a right angle in relation to the tensor block, the fastening screw can be released, damaging the injector or the cylinder head.

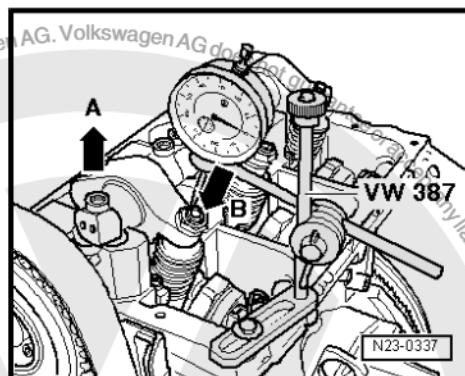
- Align the injector as described below:
- Tighten the new fastening screw in the tensor block until the injector can still be easily turned.
- Align the injector in right angle in relation to the camshaft bearing caps.
- Check dimension "a" since the external edge of the cylinder head until the rounded injector edge, using a caliper (with measuring range of at least 400 mm).

Cylinder	Dimension "a"
1	245.0 ± 0.8 mm
2	157.0 ± 0.8 mm
3	65.6 ± 0.8 mm

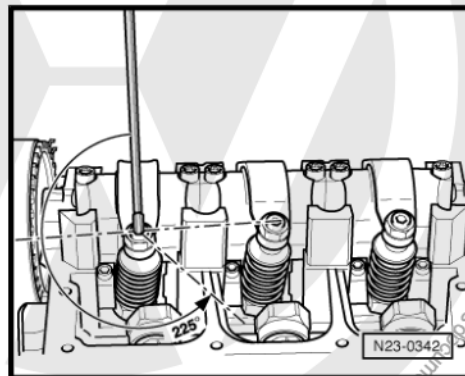
- Align the injector and tighten the fastening screw with: 12 Nm + 270° (the angular torque may be performed in several stages).
- Fix the swinging arm shaft and tighten the new fastening screws, as follows:
- Strongly tight, equally and manually, the internal and then both external screws. Then, using the same sequence, tighten with 20 Nm + 90°.



- Fix the Support - VW 387- on the adjustment screw as shown.
- Turn the crankshaft in the direction of the engine speed until the roller of the swinging arm is positioned at the top of the drive cam. Roller side -arrow A- positioned at the top of the dial gauge-arrow B- positioned in the lower point.
- Remove the dial gauge.
- Turn the adjustment bolt to the inside of the swinging arm until you feel firm resistance (injector positioning at the stop).



- Turn the adjustment bolt 225° behind the stop.
- Hold the adjustment bolt in this position and tighten the shear nut with 30 Nm.
- Fix the injector connector and install the cylinder head cap and the toothed belt cover.





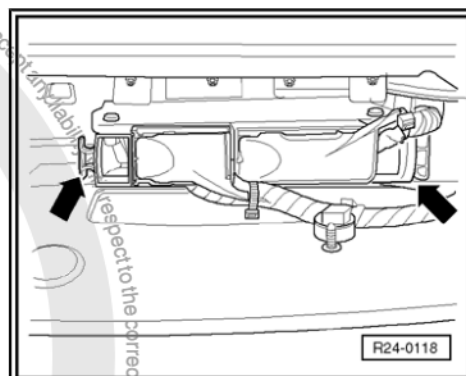
2 Engine command unit

2.1 Engine command unit - remove and install

- Before removing the engine command unit, refer to the command unit identification and its code ⇒ [page 119](#) .

2.1.1 Removal

- Turn the ignition off.
- Remove the wipers from the windscreen and the lower trim of the windscreen frame.
- Release the engine command unit and pull it out.
- Press the clamps -arrows- to the outside and remove the command unit.



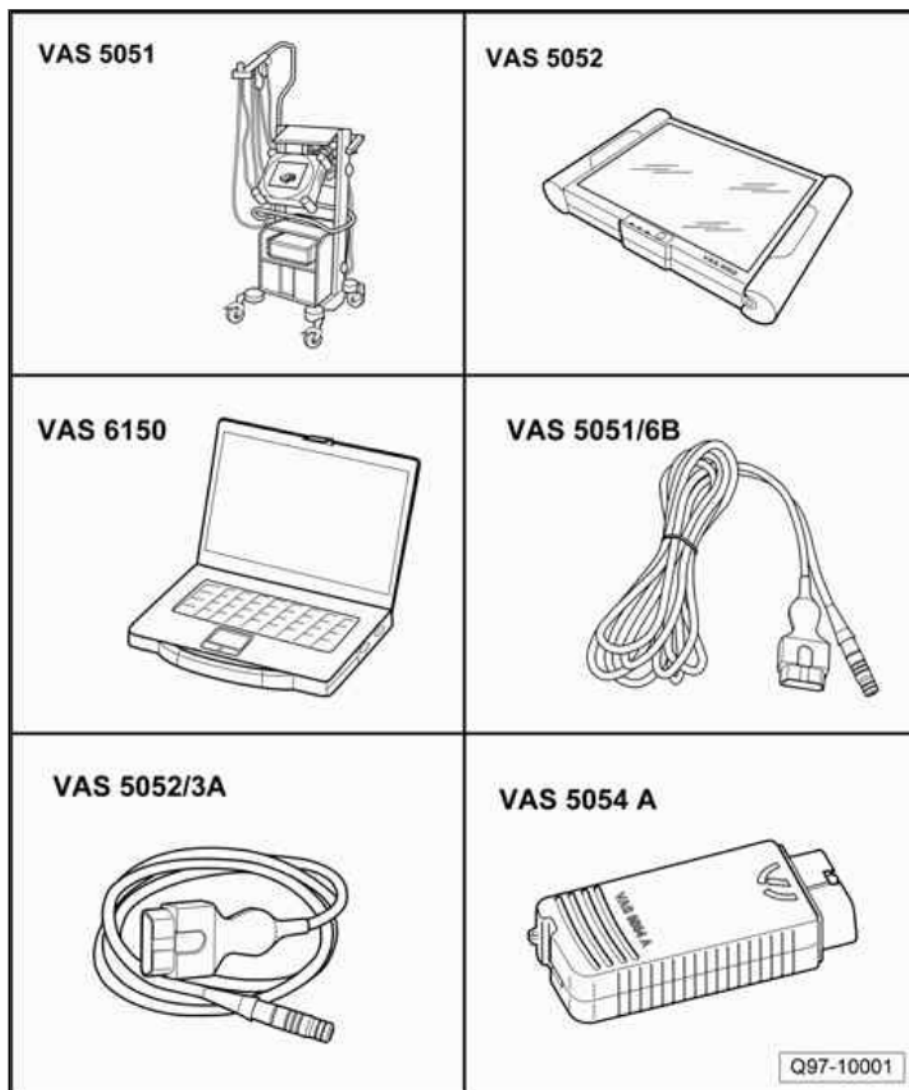
2.1.2 Installation

- Insert the new command unit.
- Fix the connector and lock it.
- Check the previous code and encode the new command unit ⇒ [page 121](#) .

2.2 Check the event memory in the engine command unit and delete it



Special tools and workshop
equipment required



- ◆ Vehicle diagnostic and service information system - VAS 5051-
- ◆ Vehicle diagnostic and service information system - VAS 5052-
- ◆ Vehicle diagnostic and service information system - VAS 6150-
- ◆ Diagnosis cable - VAS 5051/6B-
- ◆ Diagnosis cable - VAS 5052/3A-
- ◆ Wireless diagnostic connector - VAS 5054/A-

Work sequence

- Connect the Vehicle diagnostic testing and information system as follows:



- Connect the Diagnostic cable to the diagnosis connection.
- Start the engine and keep it idling.

Only when engine does not start:

- Turn the ignition on.

Select the operational mode:

- Press the **Vehicle self-diagnosis** on the display.
- Press the **Self-diagnosis** on the display.
- Press key **↵**.

The display shows the command unit identifications and the Engine control unit - J623- coding.

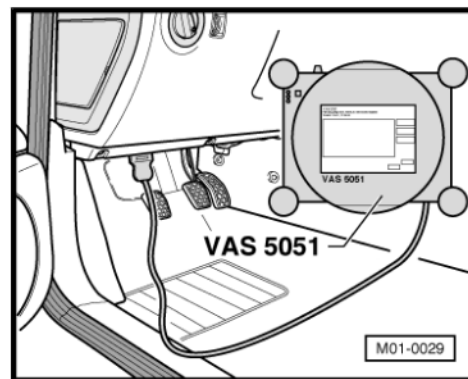
Select the vehicle system:

- Press **01 electronic engine** on the display.
- Press key **↵**.

Select diagnosis function:

- Press **004 Error memory content** on the display.
- Press key **↵**.
- Press **004.01 Check error memory** on the display.
- Press key **↵**.
- If no faults are stored in the Engine control unit - J623- , the display shows "0 faults found".
- If there are faults stored in the Engine control unit - J623- , they will be shown sequentially on the display.
- Press the **↵** key.
- Press **004.10 Erase error memory** on the display.
- Press key **↵**.
- Press key **↑**.
- Press the **Cancel/End** key.

If the operation is cancelled, press Cancel, if the operation is finalized, press End.



2.3 Adjust functions and components

Special tools and workshop equipment required

- ◆ Vehicle diagnostic and service information system
- ◆ Diagnosis cable

Select in the Vehicle diagnostic, testing and information system the "Assisted troubleshooting".

After consulting all command units:

- Press the **Skip** key.
- Select **Function/component selection**.
- Select **activate**.
- Select **engine identification codes**.
- Select **01 systems with self-diagnosis**.



- Select engine control.
- Select functions.
- Select Function or component.





26 – Exhaust system

1 Exhaust system components - remove and install



WARNING

Always replace self-locking nuts and bolts subject to angular torque

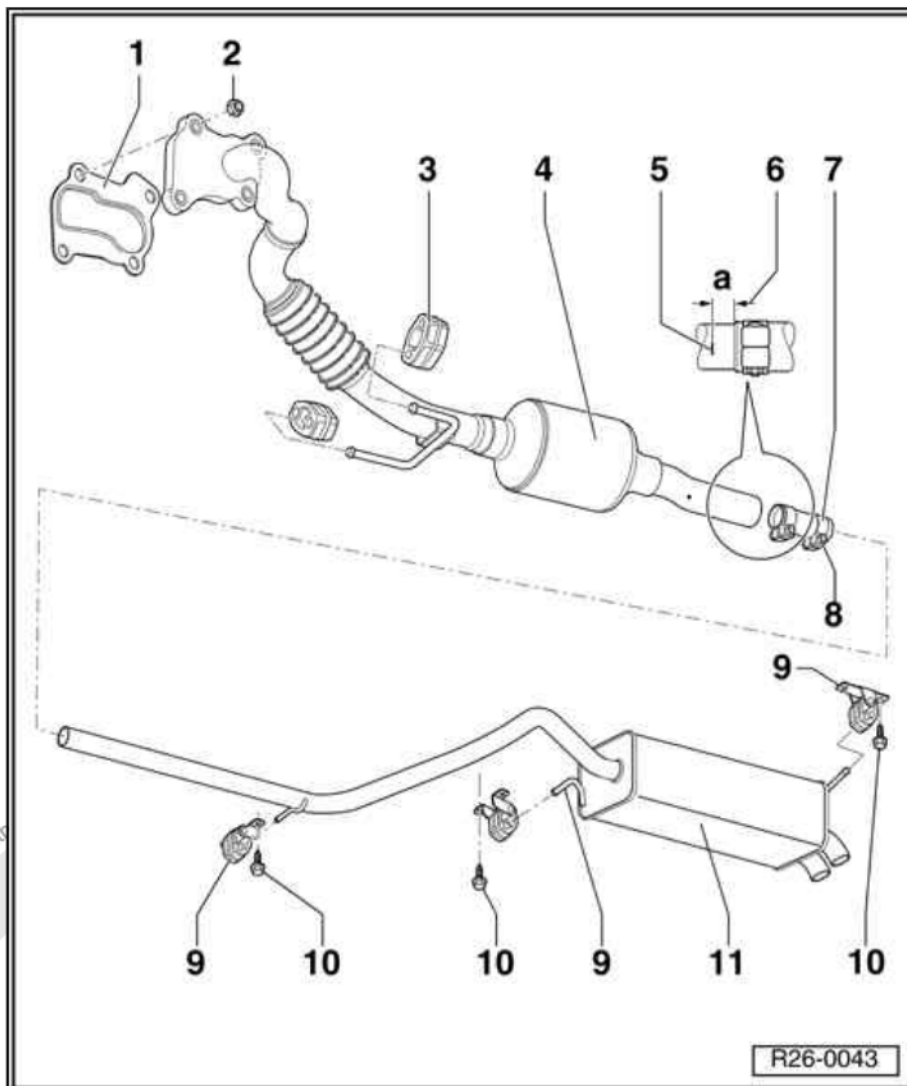


Note

- ◆ Remove and install exhaust manifold ⇒ [page 105](#).
- ◆ After finishing repairs on the exhaust system, check that there is no tension and the clearance from the body is sufficient. If necessary, loosen double clamp(s) and align the silencer and the exhaust manifold so that there is enough clearance from the body, and the supports sustain the weight evenly.
- ◆ Always replace self-locking nuts.



- 1 - Gasket
 - ☐ Renew.
- 2 - Self-locking nut
 - ☐ 25 Nm
 - ☐ Renew after each re-
moval.
- 3 - Sustaining handle
 - ☐ Replace if damaged.
- 4 - Front exhaust tube with cat-
alytic converter
- 5 - Marking
- 6 - Dimension -a- = 5 mm
- 7 - Double clamp
- 8 - Self-locking nut
 - ☐ 40 Nm
 - ☐ Renew after each re-
moval.
- 9 - Mounting bracket
 - ☐ with sustaining handle.
 - ☐ Replace if damaged.
- 10 - 25 Nm
- 11 - Rear muffler





2 Exhaust gases recirculation system

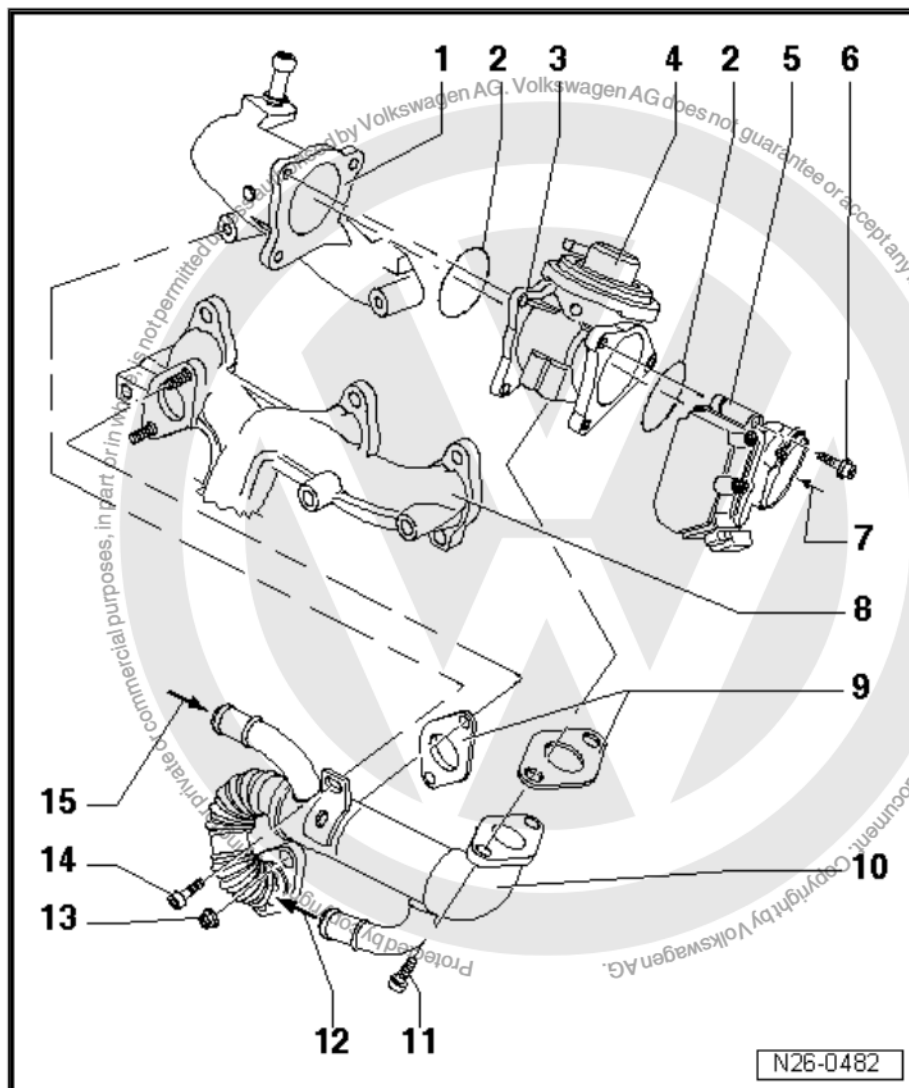


Note

- ◆ The recirculation system of the exhaust gases is done by the Control unit of the Diesel direct injection - J248- through the exhaust gases recirculation valve - N18- .
- ◆ The conical bolt of the Exhaust gases recirculation valve - N18- enables a variation of the transversal section depending on the different bolt positions.
- ◆ The pulse control enables all valve opening positions.
- ◆ Always replace self-locking nuts.

2.1 Exhaust gas recirculation system components - removal and installation

- 1 - Intake manifold
- 2 - Seal
☐ Renew.
- 3 - Intake connection flange
- 4 - Valve for recirculation of exhaust gases - N18-
☐ Part of the intake flange
☐ It can only be replaced together with the intake flange.
- 5 - Intake manifold valve motor - V157-
- 6 - 10 Nm
- 7 - From the intercooler
- 8 - Exhaust manifold
- 9 - Gasket
☐ Renew.
- 10 - Heat exchanger
☐ To recirculate the exhaust gases.
- 11 - 25 Nm
- 12 - To the heat exchanger
- 13 - 25 Nm
- 14 - 25 Nm
- 15 - From engine cylinder head

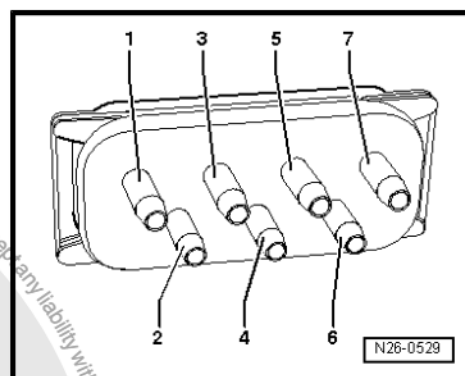




2.2 Vacuum hose connection diagram

Solenoid valve connections

- 1 - Turbocharger air filter hose.
- 2 - Turbocharger vacuum unit.
- 3 - Supercharging pressure connection in the turbocharger.
- 4 - BNM engine code - sealed.
- 5 - Air filter.
- 6 - Vacuum connection (at the unidirectional valve for the booster).
- 7 - Exhaust gases recirculation valve.





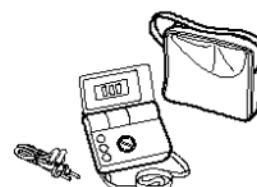
28 – Ignition system

1 Preheating system - check

Special tools and workshop equipment required

- ◆ Portable multimeter - VAG 1526C-

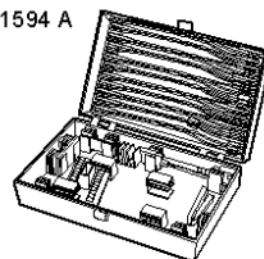
V.A.G 1526 A



W00-0431

- ◆ Auxiliary measuring cable set - VAG 1594C-

V.A.G 1594 A



W00-0477

Test conditions:

- Battery voltage at least 11.5 V.
- Ignition turned off.
- Diesel direct injection system Command unit - J248 - in order.
- Fuse 4 (30) of the battery fuse holder - S176-, Fuse 5 (30) of the battery fuse holder - S177- and Fuse 6 (30) of the battery fuse holder - S178- at the battery in order.

Test sequence

- Remove the coolant temperature sensor connector.



Note

When removing the sensor connector, the "cold" engine condition is simulated, and when turning the ignition on, the combustion chamber preheating period will occur.

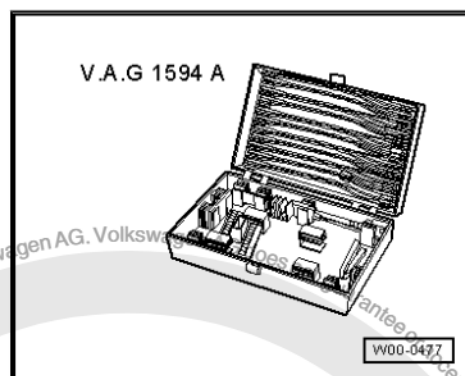
- Remove the heating plugs connectors.
- Connect the multimeter to measure the voltage between the heating plug and earth connector of the vehicle.
- Turn ignition on for approximately 20 seconds. The battery voltage should appear in the panel.
- If no voltage is indicated⇒ Vehicle diagnostic tester.



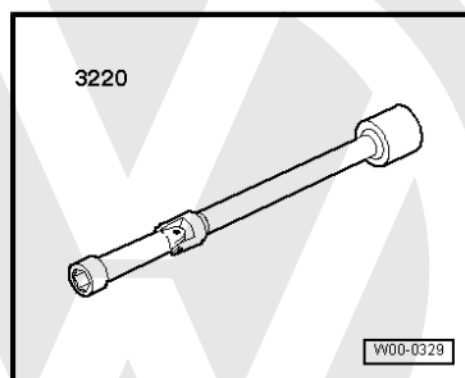
1.1 Checking heating plugs

Special tools and workshop equipment required

- ◆ Auxiliary measuring cable set - VAG 1594C-



- ◆ Extension and socket - 3320-



- ◆ Test probe - VAG 1527B-

Test conditions

- Battery voltage at least 11.5 V.
- Ignition turned off.

Test sequence

- Remove the heating plugs connectors.
- Connect the Test probe - VAG 1527B- wire, using the Measurement auxiliary cable set - VAG 1594C- to the battery positive (+) terminal.
- Position the Test probe - VAG 1527B- on each heating plug, one-by-one. If the LED lights up: glow plug OK. If the LED does not light up: replace glow plug.
- Remove and install the heating plugs with the Wrench - 3320-. Tightening torque: 15 Nm.

04.13

